OCT 11 1933

Heating · Piping and Air Conditioning

INDUSTRY AND
GE BUILDINGS.

MODERNIZING WITH PUBLIC WORKS FUNDS

Calculations for Pressure Drop in Process Piping Simplified

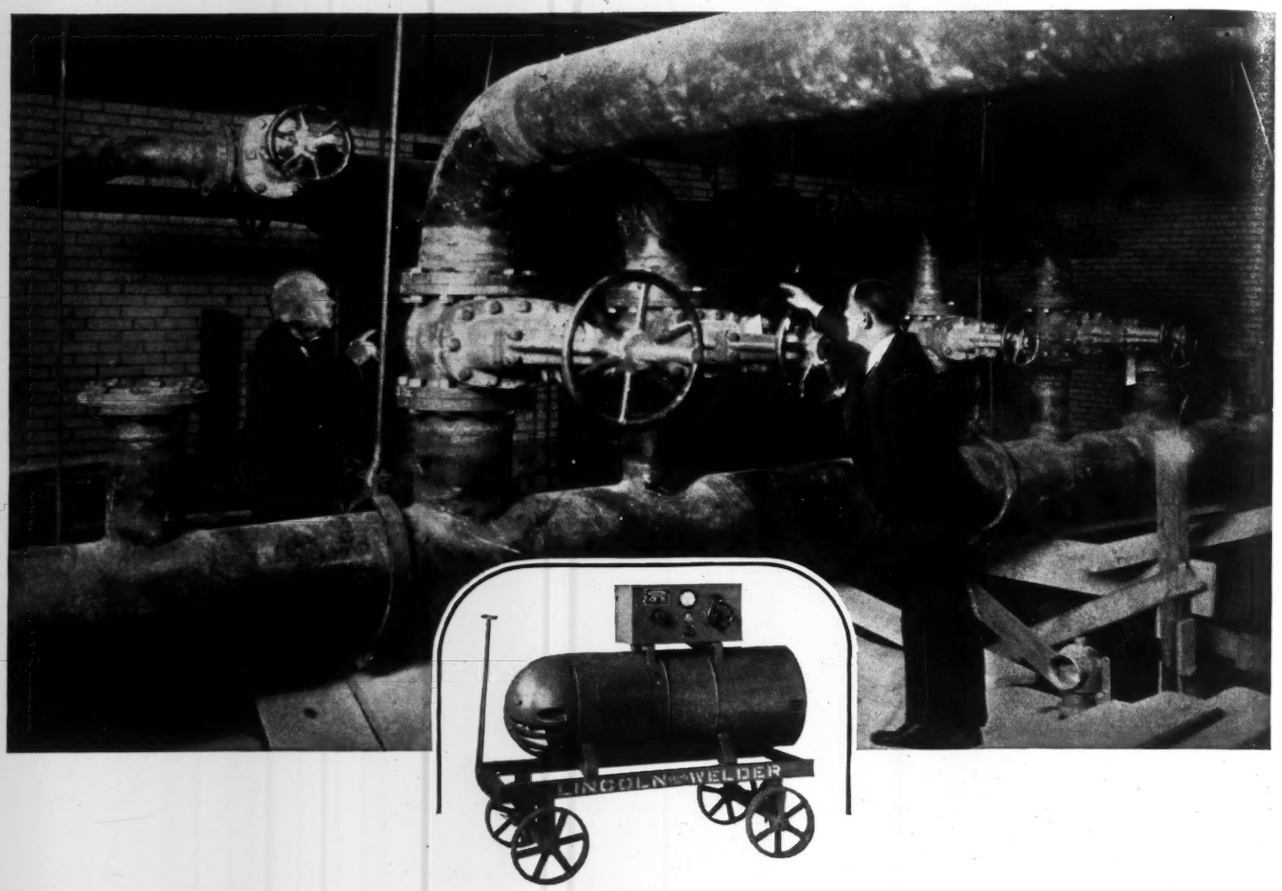
Distribution of Conditioned Air

Unit Heaters Aid Production and Processing in Many Ways

ctober, 1933

Journal Section of the A. S. H. V. E.

LAD SHOWS POP THE DIFFERENCE IN WELDING . . .



"Look here, Lad, I can't see where this job is any different than other welded jobs we've done, even though we did use the arc on this one.

"I'll have to admit though that we've run more lines in less time on this job with the arc."

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Heating · Piping and Air Conditioning

THE EDITOR'S PAGE

SUCCESS of the plan that part of the $3,300,000,000 appropriated by the government for public works be expended for modernizing mechanical equipment in existing public properties will mean much to everyone in this industry. For that reason, read the first article in this month's issue which elaborates on last month's proposal that competent consulting engineers be employed to make surveys of every existing public property with the view toward determining where modernization would be quickly self-liquidating, and assume responsibility for doing something about it if you agree with its idea.

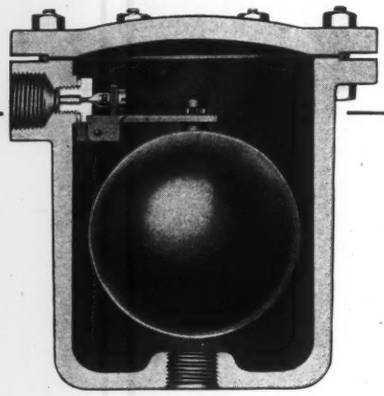
As explained, modernization of mechanical equipment in public buildings comes within the provisions of the public-works program. However, the projects that will be approved and started under this program must be initiated by some one. They must be specific recommendations, supported by facts on their economic soundness, their engineering soundness and their consistency with the aims of the NIRA. It can not be expected that because the general idea of modernization is sound the government or the Federal Emergency Administration of Public Works will go out and look for modernization opportunities. The administration will, however, consider any project of merit submitted to it.

WE believe, therefore, that this industry should push a plan for employing consulting engineers to make surveys and reports on all public works in order to get specific projects for submission. We believe that the idea of modernization is so sound that the Federal Emergency Administration of Public Works should employ these engineers. We believe that concerted support of this plan will get results, because today the public-works program is not moving so quickly as desired and a worthwhile plan should find a particularly receptive attitude.

HEATING, PIPING AND AIR CONDITIONING has on file the names of the administrators, the regional advisers, the members of the state advisory boards and the state engineers connected with the advisory boards. The latter are apparently the important contacts to make for recognition and acceptance of this plan. We will gladly supply the names of all or the name of any one state's engineer to any of our readers.

THESE are stirring and changing times. Plants must be operated more efficiently than ever if they are to survive the increased wages and shorter hours of the NRA. Heating, piping and air-conditioning systems offer many opportunities for savings and increased efficiency It is our aim each month to present in practical, usable form ideas and methods for designing, installing, operating and maintaining such systems in industrial plants and large buildings so that they will be kept at their most economical and efficient level. Process applications of unit heaters . . . charts for process piping . . . proper air distribution in an air-conditioned office building . . . piping standardization . . . are some of this month's offerings.

The Economical Way to Vent Air



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Heating · Piping
and Air Conditioning

October, 1933

PUBLIC WORKS MODERNIZATION—

Get Consulting Engineers on the Job

Facts on Specific Projects Needed to Get Action

IN last month's (September, 1933) issue of HEATING, PIPING AND AIR CONDITIONING a plan was presented advocating the expenditure of a portion of the government's $3,300,000,000 Public Works Appropriation for modernizing mechanical equipment in existing public properties. It suggested that a survey of all types of mechanical equipment in every public property be made with a view of determining where the modernization of such equipment would be self-liquidating within a reasonable time.

To make such surveys it proposed that the services of competent consulting engineers be employed. Federal, state and municipal engineers in charge of such equipment are already aware of places where economies can be effected by such modernization and should be able to make recommendations on many immediately. The possibilities for such economies are obviously widespread, however, and a survey of every public property would be justified. To do such a comprehensive job in a short time, therefore, let the services of competent consulting engineers be retained.

The plan, proposed by Russell Grinnell, President, Grinnell Co., has won favorable comment from everyone to whom it has been submitted, as far as the soundness of spending money for such modernization is concerned. HEATING, PIPING AND AIR CONDITIONING mailed its presentation of the plan itself, together with many examples of self-liquidating modernization of heating, piping and air-conditioning systems in both private and public buildings, to administrators, advisers and engineers of the Federal Emergency Administration of Public Works, to manufacturers, associations and consulting engineers in this industry. Many letters received from members of each of these groups applaud the aims of the plan.

The thing now is to get some action—get some money spent for these purposes, get equipment purchased, get consulting engineers and contractors at work.

Industry Must Take Initiative

Modernization of mechanical equipment as proposed is within the scope of the National Industrial Recovery Act. As explained later, Federal-owned properties, non-Federal public properties (which are properties owned by states, municipalities and other public bodies) and private corporation's properties used for public purposes can, by this act, be constructed, improved and repaired out of this $3,300,000,000 appropriation—by direct expenditures in the first case, grants and loans in the second, and loans without grants in the third.

Without Facts, No Action

However, the projects which will be undertaken must be suggested, must be proved consistent with the aims of the act, must be approved from the standpoint of economic and engineering soundness. Modernization of mechanical equipment in existing public properties will be approved and started only in case individual modernization projects are surveyed and, in the case of Federal-owned properties, recommended with all the facts to the Federal officials in charge of such work and, in the case of non-Federal public properties and private corporations, submitted with complete facts with applications for necessary loans to the Federal Emergency Administration of Public Works.

In other words, little of this money may be spent for such modernization purposes and most of it will be spent for road-building, bridges and other projects of no direct benefit to this industry unless the Federal government is made conscious of the soundness of this modernization for its own buildings, unless states, municipalities and private corporations are stimulated to apply for loans with which to modernize their buildings and unless they all take steps to line up the particular modernization projects worthy of being undertaken.

Survey Must Be Made

Proof of the economic and engineering soundness of modernizing obsolete, inefficient heating, piping and air-conditioning systems was presented in conjunction with this plan in last month's issue and, as stated before, mailed to all officials of the Federal Emergency Administration of Public Works. Much additional proof has been received by HEATING, PIPING AND AIR CONDITIONING from consulting engineers in various sections of the country and will be presented in these pages in future issues and offered to public-works officials as evidence to guide them in their decisions. This has already been effective in creating a receptive attitude to any applications for loans for this type of work, but that alone is not enough. The next step is that of lining up specific projects to get started.

That is the need now and, to meet it, as the title of this article says, "Get consulting engineers on the job."

Consulting Engineers Can Do It

The Federal Emergency Administration of Public Works itself does not initiate projects. It receives applications for loans, considers their soundness, recommends their approval. Federal officials may or may not initiate modernization of government properties. They should be disposed, however, to start such work if it is proved necessary and sound. The need, therefore, is to get surveys and reports on all public properties so that applications for modernization can be submitted on specific projects. Then, we will hope, they must be considered and, because of the soundness of modernization, be approved—with the result that this industry's products and services will be utilized in sufficient volume to relieve to some extent the depression conditions under which they have suffered for the last three years.

Federal, state and municipal engineers are busy on their normal tasks. The surveying of all public properties is a big undertaking, but justified by the possibilities of getting part of the $3,300,000,000 spent wisely and quickly and by the self-liquidating features of such expenditures. There are competent consulting engineers throughout the country who can make these necessary surveys and reports. Let their services be employed for these purposes by the government, by the Federal Emergency Administration of Public Works and by private corporations, and let their reports be given favorable consideration. To accomplish this, it seems to us, should be this industry's concerted effort.

Recovery Act Provides for Modernization

The National Industrial Recovery Act (title II, Public Works, sec. 201) provides for "a comprehensive program of public works" to be prepared by the Administrator, Secretary of the Interior Harold L. Ickes. The purpose underlying the entire scheme is "to increase the consumption of industrial and agricultural products by increasing purchasing power, to reduce and relieve unemployment, to improve standards of labor and otherwise to rehabilitate industry and to conserve natural resources." In other words, the government has appropriated $3,300,000,000 for a public-works program to accomplish these ends, and it wants to spend the money.

Furthermore, it wants to spend it quickly. Quoting from Circular No. 1 of the Federal Emergency Administration of Public Works, "Obviously the purpose of this act to provide employment quickly can not await the complete formulation of the comprehensive program. But it is possible to select projects which will be consistent with such program when formulated. The President and the Emergency Administration under his direction will not await complete formulation, but 'with a view to increasing employment quickly, while reasonably securing any loan made by the Administrator,' will aid in the construction and financing of any public works project deemed worthy of inclusion."

The Act (sec. 202 *a*) lists as classes of projects eligible for loans "the construction, repair and improvements of public highways, public buildings and any publicly-owned instrumentalities and facilities (such as bridges, tunnels, docks, viaducts, water works, electric power and light plants, canals, markets, etc.)". Also, the Act (sec. 202 *e*) lists the construction or completion of hospitals, the operation of which is partly financed from public funds, as eligible for loans.

Other projects, of course, such as the conservation and development of natural resources, low-cost housing and slum clearance and railroad maintenance, are included in this Act, but the above two sections are those in which the modernization of mechanical equipment in existing public properties can be interpreted as falling.

Modernization Meets Tests

The main tests will be the social desirability of the particular project, its economic desirability; *i. e.*, its relation to unemployment and revival of industry, the soundness of the project from an engineering and technical standpoint and the financial ability of the applicant to complete the work and reasonably secure any loans made by the United States. And the main preferences will be projects that are consistent with a main plan rather than isolated or inconsistent plans, projects which can be started promptly rather than those requiring delay, and projects near centers of unemployment.

If we will check the modernization of mechanical equipment against such requirements, we will find that it rates high.

Furthermore, the work of allotting the $3,300,000,000 is moving more slowly than desired, so a worthwhile

plan should be welcome if it will get more of this money into action quickly.

As for Federal projects, the government has already allotted certain moneys to projects in which the modernization of mechanical equipment will be involved. For example, $54,709,358 was recently allotted to the War Department for construction and reconditioning work on thirty-two army posts. However, the amount so allotted to date is the proverbial "drop in the bucket" compared to the total.

As for non-Federal public-works projects, the facts of the matter are that states, municipalities and other public bodies are not availing themselves to the extent it was originally thought they would of the opportunity this Act provides. The government will make an outright grant to such bodies for the construction, repair or improvement of any approved project of up to 30 per cent of the cost of the labor and materials employed upon such project. For the balance the public body can sell to the United States bonds in sufficient amount to reimburse the United States for its outlay (less the grant if allowed), or it can convey the site of the project to the United States and pay rental sufficient to reimburse the United States for its outlay (less the grant if allowed), or special means may be provided at the determination of the President.

As for loans to private corporations, the Act stipulates that they will be made to aid in "carrying out the construction, replacement or improvement of bridges, tunnels, docks, viaducts, waterworks, canals and markets devoted to public use and which are self-liquidating in character." Whether such projects could be interpreted as including modernization of mechanical equipment in certain private buildings and plants is a question to be decided for each individual case. Certainly, if any public use or good can be construed as resulting from such modernization an application for a loan from a private corporation for such purposes should be made. As pointed out before, the act does not authorize any grant in connection with loans to private corporations.

It is evident, therefore, that it is within the possibilities of the act to get the government to do more than it has done to date in allocating part of the $3,300,000,000 appropriation for modernizing mechanical equipment in existing public properties and, also, to get state, municipal and other public bodies as well as private corporations to do more than they have in applying for loans for projects including such modernization.

Set-Up of Public Works Administration

The Federal Emergency Administration of Public Works consists of the Administrator, Secretary Ickes, and various assistant administrators in Washington, ten regional advisers, forty-eight state advisory boards and forty-eight state engineers.

All non-Federal public works projects, as well as projects of private corporations, should be first submitted to the state advisory boards. The functions of these boards are to consider and promptly to submit to the Administrator with their recommendations all projects considered.

The state engineer is appointed and directed by the Administrator and responsible to him. The engineer is the executive officer of the state advisory board, employs and directs its personnel, receives, records and examines all applications and reports to the board on each. When an application is received the engineer examines it to ascertain whether it includes all necessary engineering, financial, legal and other information and elicits from the applicant further information if needed. Upon completion of the examination the engineer submits the application to the board and the board to the Administrator with its recommendation.

The functions of the regional advisers are mainly advisory, having to do with regional and general planning. They consult with the state advisory boards to the end that their action may be consistent with sound regional planning.

It Is Up to the Industry

From this resumé of the possibilities of getting action on expenditures for modernizing mechanical equipment and of the procedure in which public-works projects will be considered and approved, it is evident that anything any individual or group can do in urging state engineers and officials of the Federal Emergency Administration of Public Works to give consideration to modernizing mechanical equipment will be beneficial. We urge that if they do nothing more they write these engineers and officials and tell them of the soundness of this plan from an economic and engineering viewpoint, of the help it will be in relieving unemployment in this industry, of the public value of such a plan.

It is further evident, however, that facts are required on definite modernization projects in order to get them approved and started. Let us all, therefore, push the idea of having the government employ competent consulting engineers to supplement their own engineers for surveying and reporting on Federal projects, of having the state engineers of the Federal Emergency Administration of Public Works employ competent consulting engineers to supplement their own assistants for surveying and reporting on non-Federal public works projects, of having private corporations employ competent consulting engineers for surveying and reporting on their properties.

With facts made available in this way it will really be possible to stimulate Federal expenditures and applications for loans for non-Federal projects and for projects of private corporations.

HEATING, PIPING AND AIR CONDITIONING intends to concentrate on this plan, not because it hopes to get work for a number of consulting engineers but because it sees in such procedure the only possibility of getting widespread adoption of this whole modernization plan. It invites suggestions. It offers its co-operation to any other effort started in this direction.

Piping Standardization

By **Sabin Crocker***

.....who has been actively identified with piping standardization work for the past decade, knows his subject thoroughly. In this series of articles (of which this is the second) the status of piping standardization today is comprehensively explained, the background of the standards is discussed . . . This month's article is devoted to the standard for wrought-iron and wrought-steel pipe.

FOLLOWING the writer's article[1] on the status of piping standardization published in the September issue, the discussion is continued this month with an explanation of the development and use of the standard for wrought-iron and wrought-steel pipe. In following months materials specifications, the proposed code for pressure piping, and other subjects will be covered.

Wrought-Iron and Wrought-Steel Pipe

Of the proposed dimensional standards now being considered under *A.S.A.* procedure, that of Sectional Committee *B36* for Wrought-Iron and Wrought-Steel Pipe is perhaps of the most immediate interest. In March, 1927, the *American Standards Association,* acting on the recommendation of a survey committee, authorized the organization of a Sectional Committee on Standardization of Dimensions and Material of Wrought-Iron and Wrought-Steel Pipe and Tubing. The *American Society for Testing Materials* and *The American Society of Mechanical Engineers* were designated as joint sponsors.

The scope of Sectional Committee *B36's* work was defined as, "The ultimate aim of this Sectional Committee is to co-ordinate and standardize, with a view to reducing unnecessary duplication, the design, dimensions, and material requirements of all classes of wrought-iron and wrought-steel pipe and tubing, including: seamless pipe and tubing; lap and butt furnace-welded pipe; hammer-, fusion-, and resistance-welded pipe; and all types of riveted or other fabricated pipe made of wrought iron or wrought steel. With this end in view, it is the intent to throw all existing standards and specifications into a common pool, out of which the Sectional Committee may develop real standard specifications."

Reasons for New Standards

Until comparatively recently all commercial requirements for wrought pipe were fairly well met by the three schedules known as standard weight, extra strong, and double extra strong. The outside diameters, threads, and to some extent the wall thicknesses followed the dimensions laid down in 1886 for *Standard Pipe and Pipe Threads* by an *A.S.M.E.* committee. Recent developments in the manufacture and use of wrought-iron and wrought-steel pipe called for a revision and extension of the standard dimensions originally published in 1886, and for a pooling and elimination of unnecessary duplication in the various materials specifications formulated by different groups during the development of the pipe trade. On the dimensional side the expanding requirements of several industries had led to the use of numerous non-standard wall thicknesses. This complicated the manufacture and stocking of pipe to an extent which warranted extensive efforts toward obtaining a single schedule comprehensive enough to embrace all the thicknesses commonly used. The need for a reduction in the number of commercial thicknesses in the 8-, 10- and 12-inch pipe diameters was sensed by the Department of Commerce when it brought out in 1927, *Simplified Practice Recommendation No. 57 Covering Wrought-Iron and Wrought-Steel Pipe, Valves and Fittings.* This Simplified Practice Recommendation also served a useful purpose in eliminating from commercial lists several of the little used nominal sizes, including 4½, 7, 9, and 11-inch diameters and later the 3½-inch diameter for pipe walls heavier than extra strong.

While the Simplified Practice Recommendations helped to an extent, the problem was too complicated for solution by a method which did not embrace materials, methods of manufacture, and use as well as dimensions. It will be recalled that the original product was made of wrought iron or mild-carbon steel, while materials now available include these plus a wide variety of medium-carbon and alloy steels, particularly for the seamless process of manufacture. The original product

*Engineer, The Detroit Edison Company, and Member of Board of Consulting and Contributing Editors. Mr. Crocker is Secretary of *A.S.A.* Sectional Committee B36 on Standardization of Wrought Iron and Wrought Steel Pipe and Tubing, and of Subcommittee XXII of *A.S.T.M.* Committee A1, which is responsible for the preparation of piping specifications for high-temperature service. He also is a member of *A.S.A.* Sectional Committee B16 on Pipe Flanges and Fittings, and of Sectional Committee B31 on Code for Pressure Piping.

[1] "The Status of Piping Standardization Today," by Sabin Crocker. HEATING, PIPING AND AIR CONDITIONING, September, 1933, p. 455. In this article *A.S.A.* piping standards already published are listed, as are the standards in preparation. The steel flange standard is discussed, including a table showing adjusted service pressures for power piping at temperatures below and above 750 F and a curve showing a possible method of establishing allowable steam service pressure ratings for temperatures above and below 750 F.

was formed from skelp which was heated in a furnace and drawn through a ring and over a mandrel or ball to butt-weld or lap-weld the edges together, while nowadays pipe also is made by several seamless processes in addition to fusion-welding, hammer-welding, electric resistance welding, and other special processes. Furthermore, the original product was intended for threaded attachment to screwed companion flanges or screwed fittings, while present-day fabrication calls for welding, van-stoning, and the use of grooved couplings and dresser joints in addition to threaded connections. At the same time service conditions have changed from pressures of 100 lb per sq in. or so at maximum temperatures of possibly 250 F, to pressures of 600 to 1500 lb per sq in. and temperatures up to 1000 F.

Attacking the Problem

Hence Sectional Committee *B36* was confronted with the type of problem that can be tackled to best advantage through *A.S.A.* procedure, which provides a way for the various interests concerned to meet and to reach common understandings. In the development of the *Proposed American Tentative Standard for Wrought-Iron and Wrought-Steel Pipe (A.S.A. B36—)* which has just been released for criticism and discussion, the Sectional Committee decided early that with the variety of materials available for piping use, pipe-wall thickness schedules, to be flexible, could not be computed for any particular temperature, pressure or material. For this reason, schedules were based on P/S values, where P represents the service pressure, and S the value of allowable stress. Since the latter is dependent on the material and service temperature contemplated, all three variables were considered. Fortunately, because of the large quantities in use and the familiarity of the trade with them, it was found possible to include the present standard-weight and extra-strong schedules in the proposed standard practically in their entirety. For purposes of illustration the proposed table of "Dimensions of Welded and Seamless Steel Pipe" is reproduced here in Table 1. The schedule numbers indicate approximate values of the expression 1000 P/S. One of the first decisions reached by the Sectional Committee was to adhere to existing outside dimensions known as "iron pipe size" because of threading.

Use of the Standard

In setting up a schedule such as that shown in Table 1 it was the aim of the Sectional Committee, insofar as possible, to enable a user to fill his requirements for the various nominal sizes he needs in a given service application from a single schedule column. In this way, if a user is ordering pipe for service conditions such, for instance, as those for which he has been accustomed to specify standard-weight, he will call for *"Schedule 40."* In other words, he will have a name available by which to call the weight suitable for given service conditions. The formula employed yielded reasonably consistent results in this respect, and was well suited for the broad purpose of setting up a basic table of available pipe dimensions. It is in no sense, however, a design formula for specific types of joints and service conditions such as those given, for instance, in the proposed *A.S.A. Code for Pressure Piping.* The formula was developed by the Sectional Committee not with the idea of influencing the design of pipe, but solely for the purpose of determining a rational set of pipe thicknesses that would be consistent with the usual bases of design formulas.

In cases where service conditions and choice of materials is such as to approach the border line of change from one schedule to another, it may prove advantageous to use one of the design formulas as a guide and skip back and forth between schedules. This method of selection fits the various nominal sizes to service conditions in a more economical way than to adhere throughout to a schedule which is thick enough for all sizes. A revision of *Table 1* of *A.S.T.M. Specification A106* now in process and shown here as Table 2 will afford a rearrangement of dimensions chosen from the schedules of Table 1 to fit a given set of service conditions for a particular pipe material, viz superheated steam at 750 F for a series of steam pressures and the grade of material covered in that specification.

As an indication of the Sectional Committee's views in the matter, the following is quoted from its proposed

Table 1—Proposed American Tentative Standard—Wrought-Iron and Wrought-Steel Pipe

Table of Dimensions of Welded and Seamless Steel Pipe

Nominal Pipe Size Inches	Outside Diam. Inches	Nominal Wall Thickness Inches									
		Sched. 10	Sched. 20	Sched. 30	Sched. 40	Sched. 60	Sched. 80	Sched. 100	Sched. 120	Sched. 140	Sched. 160
⅛	0.405	.....	.....	.....	**0.068**	.....	**0.095**	.....	.....	.....	.....
¼	0.540	.....	.....	.....	**0.088**	.....	**0.119**	.....	.....	.....	.....
⅜	0.675	.....	.....	.....	**0.091**	.....	**0.126**	.....	.....	.....	.....
½	0.840	.....	.....	.....	**0.109**	.....	**0.147**	.....	.....	.....	0.187
¾	1.050	.....	.....	.....	**0.113**	.....	**0.154**	.....	.....	.....	0.218
1	1.315	.....	.....	.....	**0.133**	.....	**0.179**	.....	.....	.....	0.250
1¼	1.660	.....	.....	.....	**0.140**	.....	**0.191**	.....	.....	.....	0.250
1½	1.900	.....	.....	.....	**0.145**	.....	**0.200**	.....	.....	.....	0.281
2	2.375	.....	.....	.....	**0.154**	.....	**0.218**	.....	.....	.....	0.343
2½	2.875	.....	.....	.....	**0.203**	.....	**0.276**	.....	.....	.....	0.375
3	3.500	.....	.....	.....	**0.216**	.....	**0.300**	.....	.....	.....	0.437
3½	4.000	.....	.....	.....	**0.226**	.....	**0.318**	.....	.....	.....	.....
4	4.500	.....	.....	.....	**0.237**	.....	**0.337**	.....	0.437	.....	0.531
5	5.563	.....	.....	.....	**0.258**	.....	**0.375**	.....	0.500	.....	0.625
6	6.625	.....	.....	.....	**0.280**	.....	**0.432**	.....	0.562	.....	0.718
8	8.625	.....	0.250	**0.277**	**0.322**	0.406	**0.500**	0.593	0.718	0.812	0.906
10	10.750	.....	0.250	**0.307**	**0.365**	**0.500**	0.593	0.718	0.843	1.000	1.125
12	12.750	.....	0.250	**0.330**	0.406	0.562	0.687	0.843	1.000	1.125	1.312
14	14.000	0.250	0.312	0.375	0.437	0.593	0.750	0.937	1.062	1.250	1.406
16	16.000	0.250	0.312	0.375	0.500	0.656	0.843	1.031	1.218	1.437	1.562
18	18.000	0.250	0.312	0.437	0.562	0.718	0.937	1.156	1.343	1.562	1.750
20	20.000	0.250	0.375	0.500	0.593	0.812	1.031	1.250	1.500	1.750	1.937
24	24.000	0.250	0.375	0.562	0.687	0.937	1.218	1.500	1.750	2.062	2.312
30	30.000	0.312	0.500	0.625	.....	.....	.....	.....	.....	.....	.....

The Schedule numbers indicate approximate values of the expression 1000 P/S.
Thicknesses shown in bold-face type in Schedules 30 and 40 are identical with thicknesses for "standard-weight" pipe; those in 60 and 80 are identical with thicknesses for "extra-strong" pipe in former lists.

tentative standard; "the schedule numbers indicate approximate values for the expression 1000 *P/S*. This permits an approximation of the wall thickness if the service pressure and the value of the allowable stress for the material and service conditions are known. Recommended values of *S*, the allowable stress, may be obtained by reference to engineering codes and specifications such as the *A.S.M.E. Boiler Code*, the *A.S.A. Code for Pressure Piping, A.P.I. Specification 5L*, etc.

"It is contemplated that the user will compute the exact value of wall thickness suitable for the conditions for which the pipe is required, as described in detail in the *A.S.M.E. Boiler Code, A.S.A. Code for Pressure Piping*, etc. From the schedules of nominal thicknesses contained in the table, a thickness may then be selected to suit the value computed to fulfil the conditions for which the pipe is desired."

Many Formulas Considered

In developing a basic formula for use with *P/S* values in setting up a consistent series of thickness schedules as described above, the Sectional Committee considered a number of formulas used for the design of pipes and cylinders. Among the formulas considered were those attributed to Clavarino, Lamé, Birnie, and Barlow, as well as that known as the "common formula." The question of theoretical exactness was weighed against the simplicity and usability of each formula. This subject has been discussed at length in several places conveniently available for reference.[2] While Clavarino's formula is generally held to be theoretically correct, the empirical Barlow formula which approaches it closely is much simpler and errs slightly on the side of safety in all cases. This relation is shown in Fig. 1 where the *t/D* (wall thickness/outside diameter) ranges for well-known thickness schedules are indicated.

After weighing the arguments for and against, the Sectional Committee decided to use the Barlow formula with modifications similar to those employed in the *A.S.M.E. Boiler Construction Code* to compensate for cases where material is removed in threading, where slight corrosion exists, and where greater mechanical strength is required with thin walls than would be indicated on a straight bursting-strength basis. These considerations were brought in, not from a design standpoint, but for guidance in setting up a properly balanced and commercially acceptable set of wall-thickness schedules, from which a designer could choose for any specific application. The intention was that the basic formula would have served its purpose once the thickness schedules were set up, and that from then on pipe for a specific application would be chosen by an appropriate design formula, or to suit code requirements.

In adapting the Boiler Code formulas to its needs, the Sectional Committee had to make certain modifications. In the first place the Boiler Code pipe formulas, reproduced here for convenience, are set up to deal with minimum wall thickness measured on inspection.

Boiler Code Pipe Formulas

For sizes ¼ inch to 5 inches $P = \frac{2S}{D}(t - 0.065) - 125$

6 inches and over $P = \frac{2S}{D}(t - 0.1)$

Where

P = working pressure, lb per sq inch

[2] "National Pipe Standards," National Tube Co., pp. 288 to 300. "Piping Handbook," Walker and Crocker, pp. 30 to 40. H. A. Wagner, "Bursting Stress in High Pressure Piping," Heating, Piping and Air Conditioning, August, 1931, pp. 658 to 661.

Table 2[f]—Dimensions[a] and Weights of Lap-Welded and Grade-A-Seamless Steel Pipe[b] for High-Temperature Service—250, 300, 400, 600, 900, and 1500 Lb Per Sq In. Steam Service Pressure Ratings at a Temperature of 750 F[d]

Steam Service Pressure Rating[d,e] at 750 F		250 Lb Lap-Welded		300 Lb Seamless		400 Lb Lap-Welded		400 Lb Seamless		600 Lb Seamless		900 Lb Seamless		1500 Lb Seamless	
Hydrostatic Test[e]		750 Lb		750 Lb		1000 Lb		1000 Lb		1500 Lb		2000 Lb		3000 Lb	
Nominal Pipe Size	Outside Diameter	Nom. Wall Thickness	Weight per Linear Foot Plain Ends, Lb	Nom. Wall Thickness[c]	Weight per Linear Foot Plain Ends, Lb	Nom. Wall Thickness	Weight per Linear Foot Plain Ends, Lb	Nom. Wall Thickness[c]	Weight per Linear Foot Plain Ends, Lb	Nom. Wall Thickness[c]	Weight per Linear Foot Plain Ends, Lb	Nom. Wall Thickness[c]	Weight per Linear Foot Plain Ends, Lb	Nom. Wall Thickness[c]	Weight per Linear Foot Plain Ends, Lb
½	0.840			0.109*	0.86			0.109*	0.86	0.147†	1.09	0.147†	1.09	0.187	1.31
¾	1.050			0.113*	1.14			0.113*	1.14	0.154†	1.48	0.154†	1.48	0.218	1.94
1	1.315			0.133*	1.68			0.133*	1.68	0.179†	2.18	0.179†	2.18	0.250	2.85
1¼	1.660			0.140*	2.28			0.140*	2.28	0.191†	3.00	0.191†	3.00	0.250	3.77
1½	1.900			0.145*	2.72			0.145*	2.72	0.200†	3.64	0.200†	3.64	0.281	4.86
2	2.375	0.154*	3.66	0.154*	3.66	0.218†	5.03	0.154*	3.66	0.218†	5.03	0.218†	5.03	0.343	7.45
2½	2.875	0.203*	5.80	0.203*	5.80	0.276†	7.67	0.203*	5.80	0.276†	7.67	0.276†	7.67	0.375	10.0
3	3.500	0.216*	7.58	0.216*	7.58	0.300†	10.3	0.216*	7.58	0.300†	10.3	0.300†	10.3	0.437	14.3
3½	4.000	0.226*	9.11	0.226*	9.11	0.318†	12.5	0.226*	9.11	0.318†	12.5	0.318†	12.5		
4	4.500	0.237*	10.8	0.237*	10.8	0.337†	15.0	0.237*	10.8	0.337†	15.0	0.437	19.0	0.531	22.6
5	5.563	0.258*	14.7	0.258*	14.7	0.375†	20.8	0.258*	14.7	0.375†	20.8	0.500	27.1	0.625	33.0
6	6.625	0.280*	19.0	0.280*	19.0	0.432†	28.6	0.280*	19.0	0.432†	28.6	0.562	36.4	0.718	45.3
8	8.625	0.322*	28.6	0.277*	24.7	0.406	35.7	0.322*	28.6	0.500†	43.4	0.593	50.9	0.906	74.7
10	10.75	0.365*	40.5	0.307*	34.3	0.500†	54.8	0.365*	40.5	0.593	64.4	0.718	77.0	1.125	116
12	12.75	0.406	53.6	0.330*	43.8	0.562	73.2	0.406	53.6	0.687	88.6	0.843	108	1.312	161
14	14.0	0.437	63.3	0.375	54.6	0.593	85.0	0.437	63.3	0.750	107	0.937	131	1.406	190
16	16.0	0.500	82.8	0.375	62.6	0.656	108	0.500	82.8	0.843	137	1.031	165	1.562	241
18	18.0	0.562	105	0.437	82.0	0.718	133	0.562	105	0.937	171	1.156	208	1.750	304
20	20.0	0.593	123	0.500	105	0.812	167	0.593	123	1.031	209	1.250	251	1.937	374
24	24.0	0.687	171	0.562	141	0.937	231	0.687	171	1.218	297	1.500	361	2.312	536

[a] All dimensions in inches.

[b] While the thicknesses given in this table are theoretically ample to care for both bursting pressure and material removed in threading, it is recommended that where pipe is threaded, a weight at least equal to the 600-lb class be used to furnish added mechanical strength.

[c] These columns give the recommended thickness of pipe made of Grade A material. With a few exceptions, the thicknesses given, when substituted in the formula developed by A.S.A. Sectional Committee B36 for the classification of commercial pipe, will show a lower stress than allowed by the A.S.M.E. Boiler Code, or 9000 psi at 750 F. When calculated by theoretically correct formulas, the stress for every pipe wall is within the limited stress fixed by the Boiler Code. Where stresses calculated by the formula of Sectional Committee B36 are slightly higher than 9000 psi, which would require assigning a commercial wall thickness out of proportion to the service conditions, no increase in wall thickness was provided if the stress when computed by theoretically correct formulas was found to be lower than 9000 psi.

[d] For ratings for power piping at temperatures from 500 F to 850 F, see table of Adjusted Service Pressures for Power Piping at Temperatures Below and Above 750 F, which was published in Heating, Piping and Air Conditioning, September, 1933, p. 457.

[e] All pressures in pounds per square inch gage.

[f] Table I of *A.S.T.M. Spec. A106-33 T.*

* Conforms to "standard weight" pipe.

† Conforms to "extra strong" pipe.

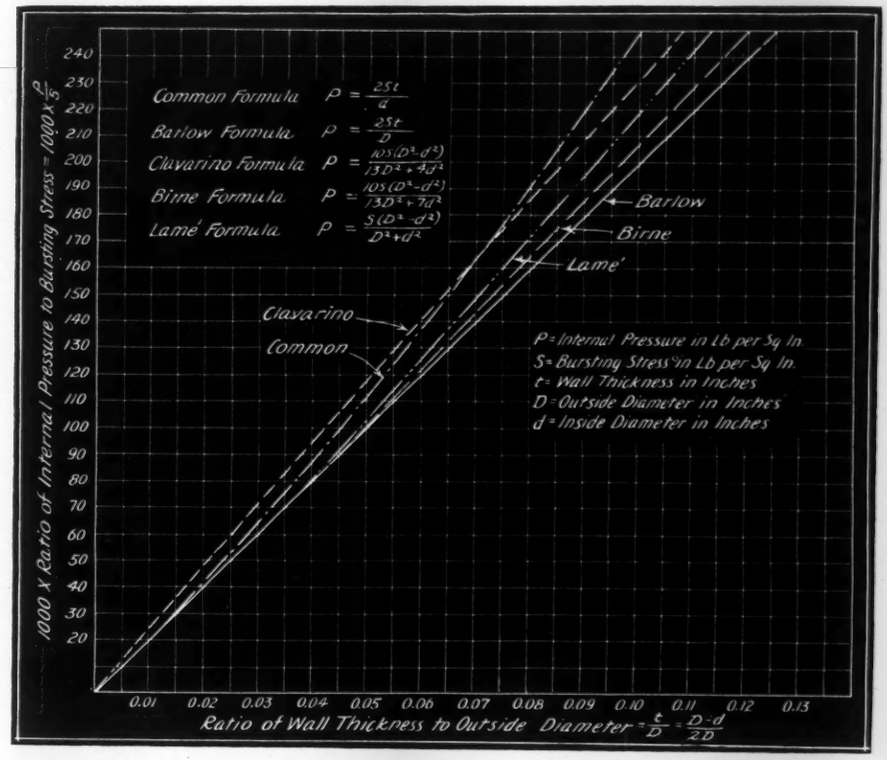

Common Formula $P = \frac{25t}{d}$
Barlow Formula $P = \frac{25t}{D}$
Clavarino Formula $P = \frac{105(D^2-d^2)}{13D^2+4d^2}$
Birne Formula $P = \frac{105(D^2-d^2)}{13D^2+7d^2}$
Lamé Formula $P = \frac{S(D^2-d^2)}{D^2+d^2}$
Barlow
Birne
Lamé
Clavarino
Common
P = Internal Pressure in Lb per Sq In.
S = Bursting Stress in Lb per Sq In.
t = Wall Thickness in Inches
D = Outside Diameter in Inches
d = Inside Diameter in Inches
1000 X Ratio of Internal Pressure to Bursting Stress = 1000 X P/S
Ratio of Wall Thickness to Outside Diameter = t/D = D-d/2D

Fig. 1—Comparison of internal-fluid-pressure formulas for pipes and cylinders

t = minimum thickness of wall of pipe, inches

D = actual outside diameter of pipe, inches

S = a factor corresponding to the allowable fiber stress (bursting stress) for material in question, lb per sq inch

Modified Formula Developed

When the Sectional Committee attempted to determine suitable values of P/S for setting up consistent thickness schedules, it was found that no one value of P/S could be fitted to both of these formulas. Consequently, if the Boiler Code formulas had been used without modification, it would have been necessary to employ different P/S values for the range of pipe sizes covered by each formula. To provide a means whereby one P/S value would serve for the entire range of nominal pipe sizes contemplated, as well as to eliminate the use of two formulas and thereby simplify the computation of pipe-wall thicknesses, it was decided to develop a modified formula which would approach the two original formulas as closely as possible.

The new formula, which became the basic formula used by the Sectional Committee in computing wall thickness schedules, was developed as follows. In the first place it was necessary to convert t from a minimum thickness on inspection to a nominal thickness suitable for use in the new pipe schedules. This was accomplished by dividing t by 0.875 to provide the required 12½ per cent mill tolerance. To give essentially equivalent results to the original formula, a constant quantity of 0.09 was assigned. The new formula then read

$$P = \frac{2S}{D}(0.875t - 0.09)$$

Wall thicknesses computed by this formula for the 1000 $P/S = 40$ Schedule agreed surprisingly well with the existing schedule known as standard-weight pipe. This condition was most encouraging, since standard-weight pipe is used more than any other, and there would be considerable opposition to extensive changes in it. Fortunately, also, most of the "Schedule 80" thicknesses could be made to agree with the old extra-strong dimensions.

To further simplify this formula, it was agreed to replace the constant 0.09 by a constant 0.0875, which permitted the following re-arrangement.

$$P = \frac{2S}{D}(0.875t - 0.875)$$

$$= \frac{2S \times 0.875}{D}(t - 0.1)$$

$$= \frac{1.75S}{D}(t - 0.1)$$

The arrangement of the last equation is similar to the Boiler Code formulas which were set up for convenience in solving for an allowable pressure from a measured wall thickness. As this is diametrically opposite from the set-up most convenient for repeated computations of the thicknesses required for a given pressure, the Sectional Committee re-arranged the terms as follows so as to put t on the left hand side of the equation, thus permitting a direct solution for t.

$$t = \left(\frac{P}{S} \times \frac{D}{1.75}\right) + 0.1$$

The final formula compensates for the 12.5 per cent minus variation in wall thickness as computed by the true Barlow formula, and provides a constant addition of 0.1 inch in thickness to compensate for threading and/or corrosion. While the final formula does not produce wall thicknesses coinciding as well as might be desired with existing practice in sizes below one inch nominal size, the results for sizes larger than one inch are surprisingly good. It was decided, therefore, to use this modified Barlow formula, and adjust the wall thickness for sizes below one inch on an empirical basis. Thicknesses which have been traditional in lists for standard-weight and extra-strong schedules have been retained in

pipe sizes ⅛ to ¾ inch inclusive in the new Schedules 40 and 80.

Wall Thickness

Among the questions debated in the Sectional Committee was whether the wall thicknesses to be adopted should be "nominal thicknesses" such as the trade was accustomed to with standard-weight and extra-strong pipe, or whether "minimum thicknesses on inspection" should be used as was done in the Boiler Code formulas. Nominal thicknesses were decided on for the following reasons:

(1) Mill practice for pipe is based on a plus-or-minus tolerance of approximately 12½ per cent from nominal thickness, rather than on a unilateral tolerance from a minimum wall thickness.

(2) If published dimensions and weights were based on minimum dimensions, the calculated weights on hangers would be too low, since actual pipe weights might be, under extreme conditions, as much as 25 per cent in excess of the minimum. This and succeeding points hinge on the fact that where minimum rather than nominal thicknesses are specified, the tolerances are all one way from design figures. As a result, any variations from design figures do not tend to cancel out as regards weight, bore, moment of inertia, etc., and the percentage variation becomes of serious proportions, especially in the case of the moment of inertia which varies as the fourth power of the diameter or thickness. It would impose too much of a burden on the entire trade as well as on designers to have to continually adjust tabular figures from a minimum to a nominal, or average basis.

(3) Shipping weights would be fictitiously low if estimated from minimum thicknesses.

(4) The pipe bore used for pressure-drop computations would be affected, which would tend to make the results in error.

(5) Computations of piping flexibility would be upset through errors introduced in determining the moment of inertia.

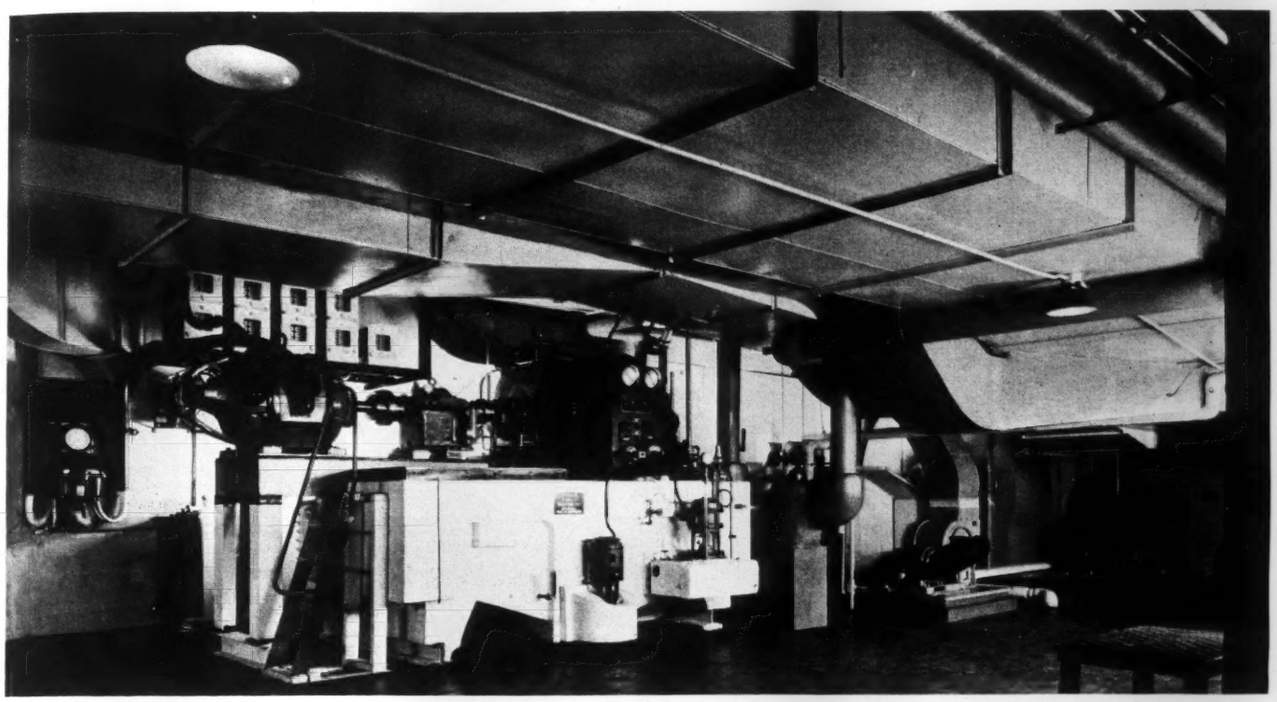
The basic formula just described was evolved by the Sectional Committee in 1930, since which time the table of "Dimensions of Welded and Seamless Steel Pipe," shown here as Table 1, and a similar table for wrought-iron pipe, have been formulated and seasoned. In this process, schedules of theoretical wall thicknesses were first computed by the formula for a series of 1000 P/S values. Commercial practice was then taken into consideration by selecting the final tabular values for wall thickness to suit existing pipe-mill equipment. This was accomplished by selecting the commercial thickness next heavier than the computed theoretical wall thickness. Due to the excellent coincidence of Schedules 40 and 80 with the old standard-weight and extra-strong schedules respectively, and to the considerable number of sizes of line pipe, well casing, etc., to choose from, it was possible to bring the theoretical and practical values into satisfactory agreement. The net result is a systematic set of schedules which should provide a sufficient variety of wall thicknesses for practical purposes in all industries, and at the same time eliminate many of the little-used intervening thicknesses. Special thicknesses for unusual applications will, no doubt, be required, but the schedules of pipe are intended to simplify stocks so that pipe in accordance with these wall thicknesses will be readily available throughout the country.

While the idea of selecting the final tabular values to suit existing mill equipment may seem to compromise the ideal with the expedient, the practical nature of the solution is necessary from a commercial standpoint. Any attempt to standardize the pipe trade along other lines would be impracticable from an economic standpoint and would meet with widespread opposition It is believed, however, that the practical nature of the present plan will be universally acceptable to the trade, especially since it has been worked out by a Sectional Committee whose membership is a good representation of the interests concerned.

Revised Draft to Be Issued

In February, 1933, the joint subcommittees working on the proposed standard reached a point where it was felt preliminary copies should be distributed for criticism by industry. Over 300 copies were mailed with an explanatory letter to various individuals and concerns throughout the country, requesting their comments. The number of replies received indicated a wide interest in the proposed standard, and many helpful suggestions were offered toward making the explanatory material more clear, and in clearing up certain inconsistencies in the tabulations. This criticism has been considered by the joint subcommittees and later by the Sectional Committee, and in the near future a revised draft will be issued for further criticism. If the reaction then indicates the material is sufficiently seasoned, consideration will be given to its publication as a *Tentative American Standard*.

The *American Standards Association*, organized in 1918 as the American Engineering Standards Committee, is a federation of 37 national technical societies, trade associations, and governmental bodies. It was founded to provide systematic means of co-operation in establishing American Standards to the end that duplication of work and the promulgation of conflicting standards may be avoided; to serve as a clearing house for information on standardization work in the United States and foreign countries; and to act as the authoritative American channel in international co-operation in standardization work. The association is supported by those groups which benefit from its activities. Its work is carried on by 400 standardization committees on which 3,000 technical experts serve as members. Announcement was recently made that many of the standardization projects formerly conducted by the *U. S. Bureau of Standards* would be turned over to the A. S. A.



The central-station air-conditioning plant, which consists of a 92-ton centrifugal compressor connected through helical gears to a 125-hp variable-speed motor, two dehumidifiers, three supply fans of capacities 18,000, 6,000 and 6,750 cfm. . . . The pumps whose functions are explained in the text are also shown in this view

Several Systems Used for

Distributing Conditioned Air

in Dime Savings Bank Building

RECOGNIZING the benefits of comfortable and healthy working conditions and regardful of the structural and mechanical features required by a truly modern building, the directors of The Dime Savings Bank of Brooklyn, New York, decided during the preparatory planning for this new building to include air conditioning for the main bank space, the officers' space and the safe-deposit department space. The air-conditioning system includes several interesting features in the method of air distribution; conditioned air is supplied the main banking space by two separate systems—one high pressure, the other low.

By **Realto E. Cherne***

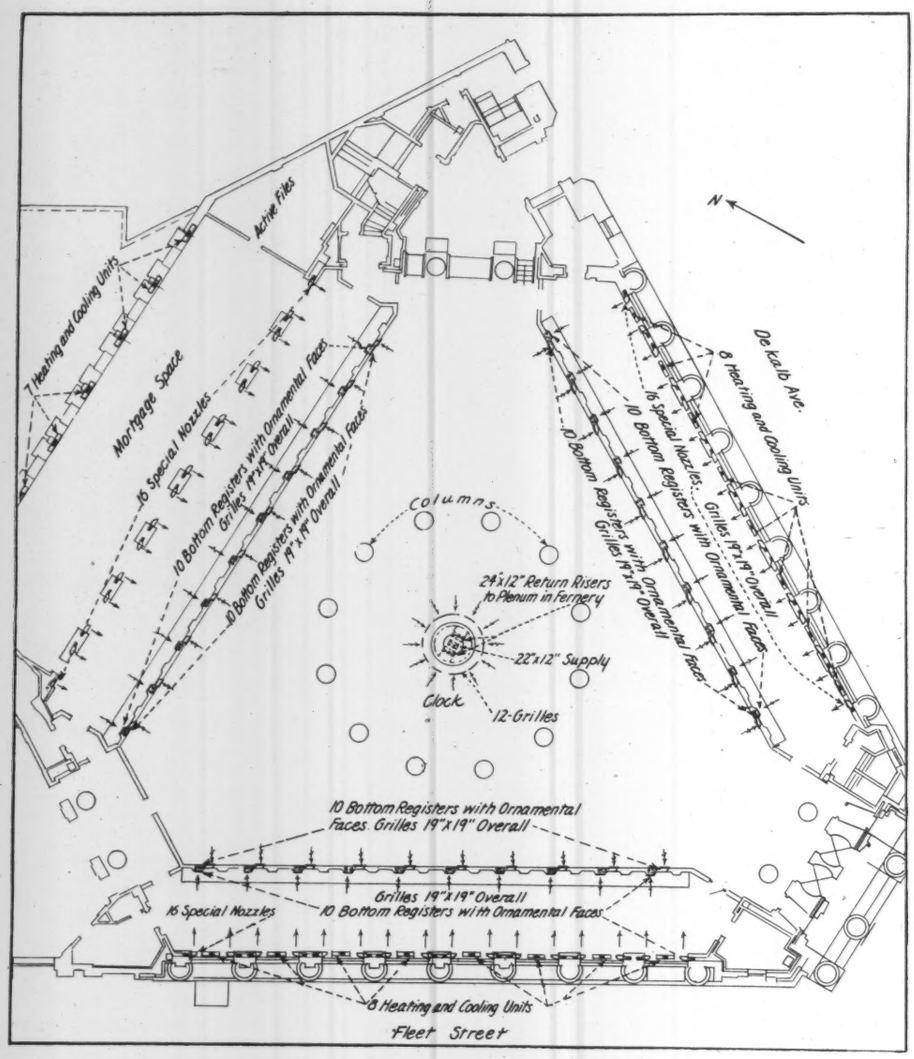
Conditioned air is distributed in the new Dime Savings Bank building (Brooklyn, New York) by means of several systems. The main bank floor is conditioned by two separate systems, one a high pressure, the other a low pressure.....This article describes the scheme of air distribution in this building, as well as the other features of the conditioning system.

*Carrier Engineering Corporation, New York City.

This recently-completed building occupies a plot which is roughly a triangle extending 219 ft on DeKalb Ave. and 286 ft on Fleet St. A huge dome, crowning the building, rises to a height of 110 ft above the street level.

The main banking space, which occupies the major portion of the first or ground floor, is triangular in shape and measures about 160 ft on a side with an area of approximately 17,000 sq ft. In the center of this 40-ft ceiling height space are twelve fluted columns arranged in a circle of 65-ft diameter. The rotunda, encircled by the columns, has in its center a triple-dial bronze clock, having as its base and pedestal a circular seat of marble. This clock is used in the air-distribution scheme, as explained later.

In the corner facing the main front entrance and the subsidiary entrance on DeKalb Ave. are located the ad-


N
Active Files
7 Heating and Cooling Units
Mortgage Space
16 Special Nozzles
10 Bottom Registers with Ornamental Faces Grilles 19"x19" Overall
10 Bottom Registers with Ornamental Faces Grilles 19"x19" Overall
De Kalb Ave.
8 Heating and Cooling Units
16 Special Nozzles
10 Bottom Registers with Ornamental Faces Grilles 19"x19" Overall
10 Bottom Registers with Ornamental Faces Grilles 19"x19" Overall
Columns
24"x12" Return Risers to Plenum in Fernery
22"x12" Supply
Clock
12-Grilles
10 Bottom Registers with Ornamental Faces. Grilles 19"x19" Overall
Grilles 19"x19" Overall
16 Special Nozzles
10 Bottom Registers with Ornamental Faces
8 Heating and Cooling Units
Fleet Street

Left—Sketch plan of the banking space, showing the location of the conditioned-air outlets, grilles, registers, etc.

Opposite—The main banking space, showing (to the left) the ornamental clock which plays a part in the air-distribution scheme. Along the wall to the right are located the outlets for the high-pressure and low-pressure conditioned-air systems. Return air is taken from beneath the wickets and through openings at the base of the clock pedestal

ministration offices. Beyond these are two private offices and a conference room. Over the office quarters there are three mezzanines and a second floor. The second floor covers the building area except for the space taken by the dome and rotunda. These spaces contain lockers, retiring and reception rooms, private dining rooms, etc. Immediately below the main floor there is a safe-deposit department consisting of vault, coupon booths, conference rooms, and administrative offices. A sub-basement covering but a portion of the lot area houses most of the mechanical equipment.

Central Station Plant Used

After consideration of the size and occupancy of the spaces involved, it was decided to adopt a central-station plant for the complete air-conditioning system. The refrigeration equipment, fans, dehumidifiers and pumps are in the sub-basement. From here a system of supply and return ducts carries the conditioned air to and from the conditioned spaces. The problem of harmonizing the various air outlets, inlets, and ducts with the architectural features was effectively solved by the distribution system utilized.

The capacity of the system is based on holding a temperature not greater than 80 F in the conditioned rooms when the outside temperature is 95 F and a relative humidity of 50 per cent when the wet bulb of the outside air does not exceed 75 F. Heating surface at the apparatus, augmented by a small amount of direct radiation on the first floor, is used to heat the conditioned areas to 75 F during heating season.

Two Dehumidifiers, Three Supply Fans

Outside air is taken from an areaway that extends down to the sub-basement, being drawn through a set of copper louvres and then through a multi-panel oil filter having a capacity of about 25,000 cfm of air, into an outside-air plenum chamber. There are two dehumidifiers, one with an approximate capacity of 4,500 cfm for the basement and the other with a capacity of about 20,500 cfm for the first floor. Three supply fans are used to distribute air to the various conditioned spaces; one having a capacity of 18,000 cfm is used for the main bank *high* system; another, with a capacity of about 6,000 cfm supplies air to the main bank *high-pressure* system; the third has a capacity of 6,750 cfm and is used to supply air to the basement. The first two of these take conditioned air from the larger of the two dehumidi-

fiers, while the latter takes conditioned air from the smaller dehumidifier. Air from the outside-air plenum chamber is drawn through preheaters and mixed with the proper quantities of air returned from the conditioned spaces before being drawn through the dehumidifiers. Air returned from the conditioned spaces is also used for bypass purposes on the basement supply and main bank high system fans, being drawn through reheaters when heating is required. Reheaters for the bank high-pressure system are located at the fan inlet.

92-Ton Compressor Cools Water

A multi-stage centrifugal refrigeration machine, having an ice-melting capacity of 92 tons per 24 hr, cools the circulating water which supplies refrigeration effect to the two dehumidifiers. The refrigeration machine is connected through helical gears to a 125-hp variable-speed motor. Water is taken from the large dehumidifier tank by a single-stage centrifugal pump (capacity 260 gpm at 115-ft head) forced through the shell-and-tube cooler of the refrigeration machine to be cooled, and then supplied to the sprays of the large dehumidifier at 25-lb pressure. A small cold-water line extends to the suction of the spray pump of the basement-system dehumidifier. This pump (capacity 55 gpm at 70-ft head) mixes the cold water with water from the dehumidifier tank before supplying to the sprays. There is an equalizer line between the dehumidifiers which eliminates a separate return water line to the refrigeration machine. Properly valved bypass arrangements are provided to allow local recirculation at the large dehumidifier during winter operation when the refrigeration machine is not in use.

Well water at a temperature of 55 to 60 F is utilized for condensing purposes; the well pump has a capacity of 185 gpm. An auxiliary city water connection is provided for emergency use.

The Scheme of Air Distribution

Safe-Deposit Department

The safe-deposit department, in the basement, consists of a vault, 21 coupon booths, three conference rooms, an entrance lobby and two offices. A securities vault and bank examiners' room are also located on the basement level, bringing the total basement floor area of the conditioned spaces to about 6,800 sq ft.

Air distribution in the various rooms is accomplished by use of overhead pan outlets. Generally, the lighting fixtures serve as deflector pans for the air outlets, this effectively harmonizing with the architectural features of each room. The return air is taken from near the floor so that cold air can be removed from the floor during the heating season. There are small pan outlets, supplying air into each of the 21 coupon booths. The doors are undercut to allow the air to escape to the return-air outlet at one end of the coupon booth lobby.

There are no duct connections to either of the vaults. To provide for ventilation of the safe-deposit vault, suf-

ficient additional conditioned air is supplied to the room adjacent to one of the vault doors. Return air is taken near the other vault door, thus inducing a movement of air through the vault. In other words, a positive pressure on one adjacent room forces air through the vault into the other adjacent room, which is under a slight negative pressure. The securities vault is provided for in a similar manner, except that the air is supplied to a small ante-room to an auxiliary side entrance. Air is relieved through the vault as before. Circulation of air in the vaults is induced by small ceiling fans.

Main Banking Space

The main bank floor is conditioned by two separate systems. One, a *high-pressure system,* delivers air through grilles in the window sills of the lower windows. Units suitable for both heating and cooling are installed beneath each low window. Direct radiation is not required where these units are used since an extended-surface heating coil is an integral part of each unit. The air supplied from the fan located in the basement (called *primary air*) issues from the unit through an adjustable nozzle. This primary current of air induces a secondary air flow through the heating coils. Sufficient heating surface is installed to heat the spaces to 75 F in zero weather with primary air being supplied, and 55 F without primary air (ordinary night and week-end operation).

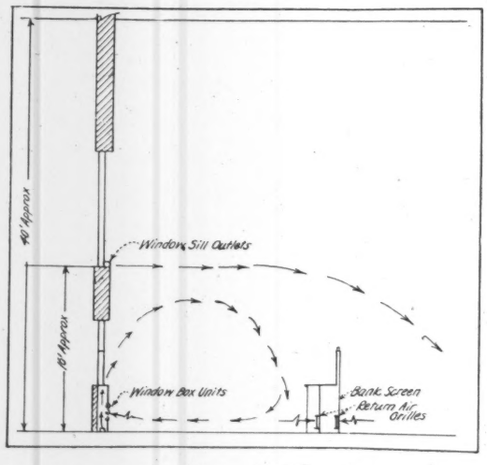
A total of 24 such units are located around the perimeter of the main bank space. In addition, two are located in the president's office, two in the treasurer's office, two in the conference room, and one in the file department office. The latter, together with one of the 8 window-box-type units located in mortgage department space is a special unit which supplies air horizontally at an elevation of about 8 ft from the floor rather than through a window-sill grille.

The second system, called the *high system,* is used for conditioning the first-floor bank space and administrative offices; it is a comparatively low-pressure system which supplies air through 48 special outlets located on the sills of the high windows. Ducts carrying air to these outlets are furred in the pilasters, a duct leading to each outlet. The outlets are each about 24 in. long by 3 in. high and are especially designed to provide for the length of blow, temperature differential, and elevation above the floor encountered on this installation.

This system also supplies air to the officer's space through overhead pan outlets forming part of the lighting fixtures.

In the center of the rotunda, air is supplied through and around the numbers on the three clock faces at an elevation of about 12 ft above the floor. This is done to insure positive circulation to the entire circle bounded by the free standing columns.

Return air is taken from beneath the wickets and through openings at the base of the clock pedestal.



Sketch showing locations of the outlets for the high and low air-distribution systems

Control Is Compressed-Air Type

The entire plant is under the automatic control of instruments and devices using compressed air for motive power.

In addition to the standard dew-point controls which regulate the operation of the outside-air and return-air dampers and steam valves on the preheaters, there are individual thermostats controlling steam valves and by-pass dampers on the separate fan systems.

During summer (dehumidifying) operation, the apparatus dew-point temperature is controlled at the refrigeration machine by means of a single-duty regulator which limits the amount of condenser water being used. Major changes of load are provided for by manually changing the speed of the centrifugal compressor.

Dual-type thermostats, allowing a change of room temperature during heating season from day operation (72-75 F) to night operation (55 F) from one remote control position control the steam valves on the window-box-unit heating surfaces.

Safety controls, including a thermostat, regulating the steam admitted to the outside row of preheaters, used to prevent freezing of the spray water, a minimum temperature control on the refrigeration machine which prevents freezing of the tubes in the evaporator in the event of a sudden decrease in load, and a flow control which stops refrigeration in event of a decrease or discontinuance of the cold water circulation, are provided.

Indicating, Recording Instruments Aid Operation

Mercury thermometers are located on or near all thermostats to facilitate in the setting of the instrument. The temperatures of the condenser-water supply and discharge, refrigerant temperature, and refrigerated-water supply and return temperatures are also indicated by mercury thermometers.

In addition to the above temperature indicators, there are ten dial vapor-tension-type, remote-reading thermometers grouped on a panel in the apparatus room. These facilitate the proper operation of the entire system since from this location may be read the following temperatures — bank apparatus dew point, basement apparatus dew point, outside air, main pump discharge, booster pump discharge, high-pressure fan discharge, main-bank fan discharge, basement fan discharge, bank return air, and basement return air.

Air-pressure and water-pressure indicating gages are located in places where a pressure reading will assist in the operation of the system.

In the engineer's office on the basement level there are four vapor tension bi-recorders

which indicate and record the temperatures of each fan discharge, each dew point and each return air. The charts from these recorders allow a permanent record of operation to be kept and also give the chief engineer a method of determining the operation of the plant from a remote station.

The control for the dual type thermostats is also in the engineer's office.

Operation of the Plant

It has been found that during the summer dehumidifying season, the normal daily operation of the plant extends from about 7:30 a. m. to 4 p. m., after which it is possible to shut down the refrigeration plant, basement apparatus, and main bank high-system fan. The high-pressure window-box system continues in operation until 5 p. m. to maintain conditions in the employes' work spaces during working hours.

During the heating season, it is necessary to set the dual thermostats to day operation and start the fans at about 7:30 a. m. in order to have the bank up to temperature by the time the employes arrive.

The temperatures and humidities in the conditioned spaces are varied with major fluctuations of outside weather conditions by manually setting the controlling instruments. Thus, with 95 F outside, the temperature inside will be about 80 F; with 85 F outside the temperature is maintained at about 76 F.

Pipe Welding Plays an Important Part in Modernizing Breweries†

By **F. W. Rabe***

THE art of brewing beer made considerable progress during the last twenty years in those countries where beer was legally produced and sold. Not only was this progress confined to achievements in the yield of the wort produced from the grain, but also to more economical production of such indispensable agencies as steam, refrigeration and power. Modern and more efficient equipment is today replacing antiquated and time-worn apparatus, and the steam, refrigeration, and power plants are so designed to operate, if possible, in accordance with a carefully worked out heat balance, in order to reduce the cost of steam and power as well as refrigeration to a minimum. In addition, much thought is being given to more economical application of refrigeration as, for instance, the use of higher suction pressure of the refrigerant throughout the plant, lower steam pressure and a greater utilization of heat-recovery equipment.

When it became apparent that beer was to become legal, a rehabilitation program was inaugurated that involved every department of the vast Anheuser-Busch organization; welding played an important part.

There were literally miles of piping to be installed in the cellars. These included refrigeration, brine, water, steam, fuel gas, CO_2 gas, grain and air lines, ranging in size from ⅛ to 20 in. Since it is very difficult, due to small openings and the many tanks in the cellars, to bring in pipe and material, it can be seen that to bring in short lengths of pipe that were threaded and would have to be coupled would make a very expensive installation. Quite a bit of the pipe had been in use so the old flanges had to be burned or screwed off because most of them would not mate. Most of the pipe was welded to save time and expense.

The entire ammonia condenser layout was changed from the atmospheric type to shell-and-tube condenser. All the discharge lines from the ammonia compressors were welded, as well as the headers over the condensers. On this large-size pipe, welding was a real time and money saver.

The site of the refrigeration plant is bounded by streets that are not parallel, for which reason the building is in the shape of a parallelogram. Many of the lines therefore enter others at various angles. Welding facilitates the joining of two lines under such conditions. A welded ammonia suction line is cheaper to insulate than a flanged line, and the insulation lasts longer because there are less joints which admit air.

One particularly great saving is effected when a large line, 12 in. or over, already in place is to be added to. In that case, a hole can be cut while the pipe is in place and a branch welded on. This was done a number of times during the reconstruction work.

Welding of pipe-work makes it possible to put the whole pipe shop on a hand truck which can be moved to any part of the plant in no more time than it takes a man to walk to that particular location.

*Assistant Chief Engineer, Anheuser-Busch, Inc., St. Louis, Mo.

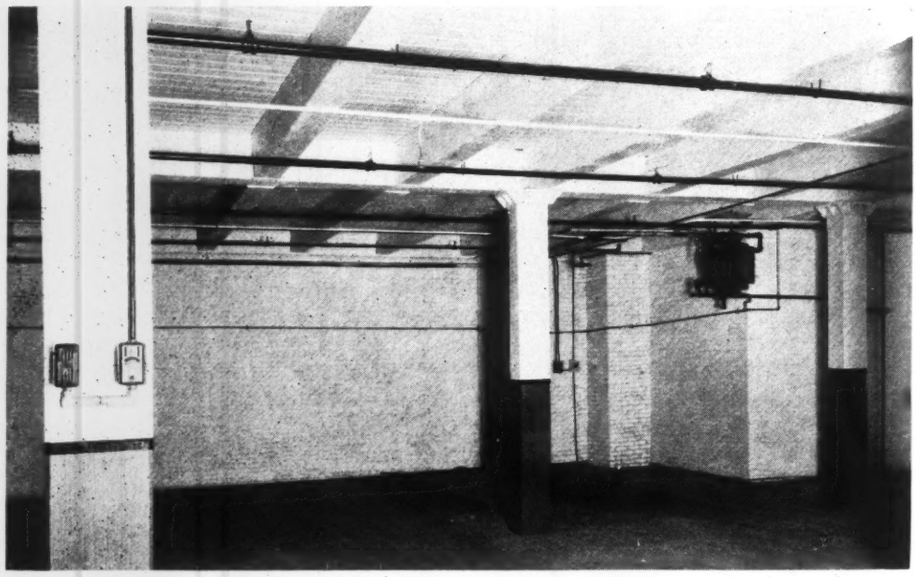
†From a paper read at the 34th annual convention of the *International Acetylene Association*, held at Chicago, September 26-29, 1933. Among the other papers presented at the meeting of particular interest to readers of Heating, Piping and Air Conditioning were "Pipe Welds and Weld Tests," by F. C. Fantz, Vice-President, Midwest Piping & Supply Co., Inc.; "Importance of Welding and Cutting in Engineering Eduction," by Prof. G. L. Larson, University of Wisconsin; "Importance of the Technician's and Welder's Ingenuity," by G. O. Carter, Consulting Engineer, The Linde Air Products Co.; and the Oxy-acetylene Committee Report, a 106-page booklet.

Registration at the meeting was approximately 430.

The Modern Unit Heater a Production Aid . . .

. . . Solves Many a Plant Problem Other Than Strictly Space Heating

IN ADDITION to the extensive use of modern unit heaters for meeting plant heating requirements with efficiency and economy, they have proved themselves adaptable to solving a variety of industrial problems which do not come under the head of space heating; these might be termed production or process uses. Examples include installations of unit heaters for drying purposes; for dispelling fog and vapor from vats, etc.; preventing condensation; for product or material conditioning; distilling water for some particular process; and for numerous other purposes.

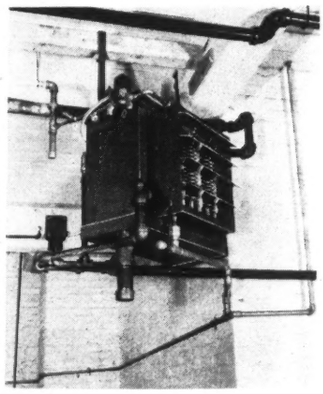


It is the purpose here to describe a number of these cases where units are used in this manner. By no means do the examples given show all such possibilities for employing unit heaters advantageously. They are suggestive, however, of the wide range of opportunities for utilizing this equipment in plants, other than for strictly space heating.

Humidifying Units Provide Proper Conditions for Product

A case where unit heaters equipped with means for humidifying the air solved a problem in the plant of a manufacturer of leather shoe soles is cited by D. L. Higgins of B. F. Sturtevant Company. In this plant it was noticed that when the relative humidity was about 50 or 60 per cent, waste due to cracking and tearing was less than during the heating season when the air in the plant was much dryer. It was therefore decided to equip the plant to provide the right relative humidity the year around.

Units are used to heat the manufacturing spaces. The type of unit used is a conventional suspended heater, to which is added an extra steam coil. On this steam coil are cup-like fins, so connected to the water supply that the fins are kept full of water during humidifying periods. The air enters the inlet side of the heater and is warmed to approximately 120 F; this warm air then flows across the humidifying coil where it picks up moisture. The adjustments are so set that there is no loss of water, and only the amount of water that can be evaporated is allowed to flow into the unit.



Results from installing these humidifying unit heaters in a leather shoe sole manufacturing plant have been a saving due to waste being cut to a minimum, and a better product. The small view is a close-up of one of the units

Thermostats and hygrostats located at points distant from the units control them. The thermostats are set to keep the building at 65 F during the day and at 50 F

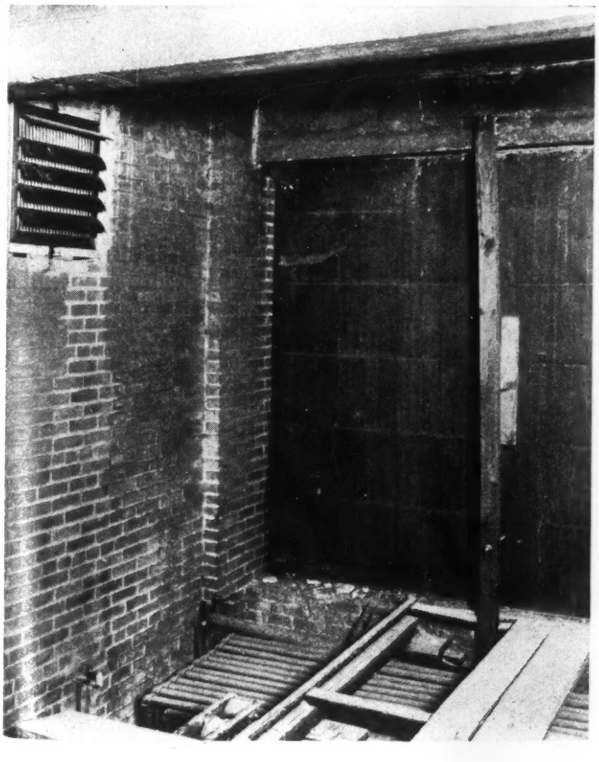
In addition to heating industrial plants effectively and with economy, the modern unit heater has proved its usefulness in a variety of miscellaneous process and conditioning uses. Among these uses are included numerous drying applications, dispelling fog and steam rising from vats, preventing condensation, etc....Suggestive of the adaptability of unit heaters as a production aid are the examples given in this article.

at night. During the daytime the hygrostats maintain a relative humidity of 40 per cent, this being increased to 60 per cent at night. The lower humidity is necessary during working hours in order to maintain comfortable working conditions; the higher humidity during non-working periods "soaks" the leather products and compensates for loss of moisture during the day.

A saving has been the result, as waste has been reduced to a minimum. The product does not crack or tear, and (according to the management) the plant is now able to turn out a better grade of goods.

Units Replace Pipe Coils for Lumber Drying

In direct contrast to the above example—where humidification was required—is that furnished by A. G. Getz of The Bishop & Babcock Mfg. Co.—the installation of a number of units in the dry kiln of a lumber company to facilitate the drying and curing of lumber.



Unit heaters aid in the drying and curing of lumber in this dry kiln, replacing to advantage the pipe coils formerly used

The original installation consisted of a drying room utilizing a vast quantity of pipe coil as a source of heat. The pipe coils were installed in a space below the floor level of the room and equal in area to the floor space of the room. I-beams over the pipe coils at the floor level enabled the lumber to be stacked over the coils.

After a number of years' operation the pipe coils began developing leaks and it was found that the whole system could be replaced by unit heaters at much less expense than was necessary even to make the required repairs. Accordingly a number of unit heaters were installed at advantageous points around the kiln. These units supply fresh air from outside and are thermostatically controlled in order to prevent any danger of supplying air at too high a temperature, which would result in case-hardening of the lumber.

The air from the units is exhausted from the room after passing through the lumber. This installation has been in service a sufficient length of time to prove its efficiency over the old system of pipe coils. Three advantages of this installation are:

(1) The cost of the unit heaters was less than the cost of repairing the original installation of pipe coils.
(2) A considerable saving has been effected in the fuel cost, as the unit heaters have a higher efficiency than did the pipe coils.
(3) Fresh air, having a low moisture content, is constantly supplied and positive circulation is assured. This, of course, is a major advantage of the installation as previously the circulation of air over the lumber was dependent upon gravity.

One of the accompanying illustrations shows this job, and is especially interesting in that a part of the large amount of pipe-coil surface which has been displaced by the unit heaters is shown below the track rail.

Another installation of unit heaters for a drying purpose is in a rug-cleaning plant, where it is necessary to dry rugs and carpets rapidly after washing.

Units Dispel Fog and Steam

Another installation (at present under consideration) mentioned by Mr. Getz is the installation of unit heaters to remove the dense steam and fog-laden atmosphere existing in a dye-processing plant. The plans call for units of the centrifugal-fan-type to be installed near the ceiling, suspended in such a way that the outlets will be in a downward direction. Ducts are to be connected from the outlets and run vertically downward to a distance of approximately 2 ft above the floor level. At this point, 45-deg elbows, or outlet cowls, will be installed so that the air will strike the floor at approximately 45 degrees.

The units will be connected to fresh-air intakes so that a constant supply of outside air having a low moisture content will be available. Fixed dampers will be installed in the fresh-air intake so that the unit can supply either fresh or recirculated air, the recirculated air effecting a saving in the heating cost when heating up in the morn-

ing before the plant is in operation. The principle of operation consists of the fact that warm air having a tendency to rise will, after striking the floor, accordingly ascend carrying the fog-laden air surrounding the dyeing vats with it. The fog- and steam-laden air will then be exhausted at the ceiling.

The units in this case fill two requirements: first, the principal requirement to eliminate the fog surrounding the dyeing vats and, second, they are a source of heat for meeting the building heating requirements.

Two examples of the use of unit heaters for preventing condensation in dye houses were given in an article[1] by John R. Cooper of Thermal Units Co. This writer looks on the problem as one of *air transportation;* if air at a certain temperature will not hold more than a certain amount of moisture, and more than that is continually being furnished from steaming tubs, etc., the answer is to furnish the proper amount of additional air required for the purpose—this air to be heated to at least room temperature prior to admission. In this article it is stated that as a rule 10 air changes per hour will be sufficient if exhaust fans are used to remove the moisture-laden air, and about 15 if exhaust fans are not used.

The two cases given by Cooper and illustrating the application of these principles follow:

At the Waldrich Bleachery, Delawanna, N. J., there was a room 100 ft × 100 ft, saw tooth construction, truss height 14′-0″, and peak height 22′-0″. Two sides were exposed and one side was open to an adjoining dye room, but for purposes of estimating requirements, this was disregarded, since that room was handled separately.

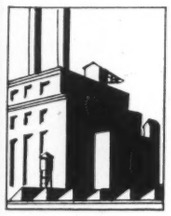
The cubical contents were calculated at approximately 172,000 cu ft and because it was desired not to use exhaust fans, 15 air changes were decided upon. This meant that approximately 2,380,000 cfh of outside air had to be introduced with a temperature rise from zero to approximately 75 F.

Units raising 7258 cfm from zero to 78 F, operating with 80 lb steam, with face velocity of 1,264 fpm were used, being qualified in other ways to meet the needs of the occasion.

Multiplying by 60 to reduce to an hourly basis, we find that one unit would handle 435,480 cfh and six units would handle 2,612,880 cfh, slightly more than required. (Five units would have probably proved sufficient, but six units insured uniformity of distribution.)

The triangular spaces forming the side walls of the saw-tooth roof construction seemed ideal for the location of the units. The direction of air currents insures continuous circulation generally throughout the room which was thought essential in view of the fact that no exhaust fans were used, the moisture-laden air being forced out of vents placed in the roof for that purpose.

The units were hung below the truss line, in order to prevent any interference with air movement and connected with ducts to the outside air, having a face area approximately the same as the face area of the unit, 30 in. × 30 in. or 900 square inches. This was an important point, as the particular propeller type fans used, while efficient for free air delivery, are not adapted for use when duct areas are sufficiently small or the duct is long enough to build up a considerable back pressure.



The installation at the Gaede Silk Dyeing Co., at Paterson, N. J., is also of interest. Here we had a room 70 ft × 60 ft of the monitor type, one side only exposed to outside air, adjoining rooms three sides, roof trusses 14′-0″ high with a monitor roof 28′-0″ high. The cubic contents were approximately 78,400 cu ft.

Ten air changes were considered sufficient, which meant that 784,000 cfh had to be handled.

For this purpose, two unit heaters were used, each raising 7,258 cfm from zero to 76 F with 70-lb steam.

The total air delivery amounted to 2 × 7258 × 60 =770,960 cfh which was considered close enough to requirements.

In this case, however, a recirculating damper was placed in the duct in order to give variable control of outside air and recirculation of inside air, if such should prove advisable. This was, however, hardly ever used, and was not considered necessary when additional equipment was purchased for other rooms.

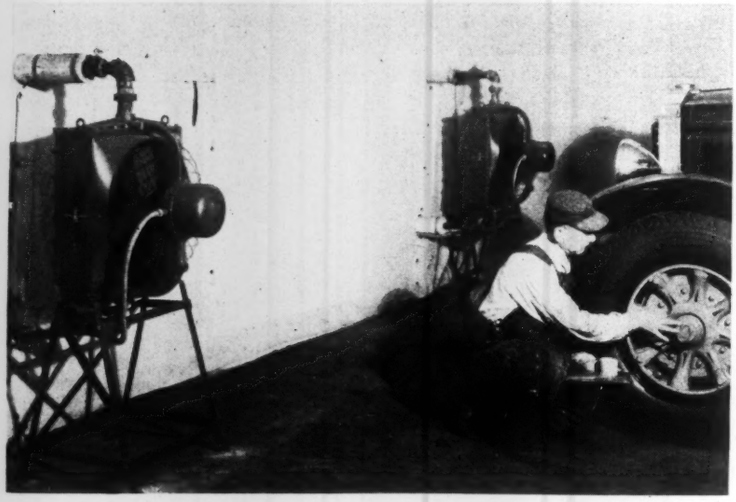
One unit was placed in the duct leading to the outside wall and the other connected with the duct to the roof, both units being hung below roof trusses, with air currents insuring a continuous circulation.

Because of the high monitor roof construction, a small amount of condensation developed in that section. This was due to the slowness of air movement over the cold roof construction and could have been prevented by the installation of exhaust fans opposite the unit heaters in the monitor or by increasing the volume of air introduced from the outside, either of which would have materially increased air movement, reducing the time of contact with the cold roof, which would have eliminated this objectionable feature.

The expense of additional equipment was not considered justifiable, in view of the small amount of trouble from the condensation that developed.

(To page 516)

[1] Heating, Piping and Air Conditioning, September, 1930, p. 767.



These unit heaters are installed for the quick drying of newly-painted truck bodies. The object was to speed up the drying to increase production with given paint-room equipment

A Series of Charts to Simplify

FLOW AND PRESSURE-DROP CALCULATIONS

for Process Piping

THIS series of charts (the first two of which appear this month) has been designed to facilitate the making of pressure-drop calculations; the detailed numerical work necessary in making such calculations for process piping is eliminated. The accuracy of the charts is well within the limits with which the data are known in most cases. When greater accuracy is desired, these charts furnish a quick method of getting a first approximation. The friction-factor curves on which these charts have been based were given and discussed by the author in the May, 1933, HEATING, PIPING AND AIR CONDITIONING. These values were those found for new, clean, steel pipes. The pressure drop found from these charts will be applicable to the average new, clean, steel pipe as it comes from the factory.

This series of charts will cover standard pipe sizes from ¼ to 4-in. diameters. The range of viscosities has been chosen to cover a range that will take care of any ordinary process fluid that is being piped.

Allowing for Roughening and Accumulations

The determination of pressure drops in rusty or corroded pipes, or pipes with deposits on their interiors, is much more difficult. In general two factors will affect the pressure drop in pipes in use. The more important in most cases is the change of pipe diameter caused by accumulations and the other is the roughening of the surface as caused by pitting or variations in shape from one section to the other due to the deposits forming unevenly along the pipe. In the article by the author in the June, 1933, issue it was shown that when the equation for pressure drop was expressed in terms of the volume of flow that the pressure drop varied inversely as the fifth power of the diameter. For example, if the pipe diameter is decreased by 2 per cent the pressure drop will increase in the ratio of $1^5/0.98^5 = 1.105$ or the pressure drop is increased 10.5 per cent. The following values show how the pressure drop increases with increased amount of accumulations:

PER CENT DECREASE OF DIAMETER	FACTOR BY WHICH PRESSURE DROP SHOULD BE INCREASED, PER CENT
1	5
2	10.5
3	16.5
4	22.5
5	29
6	36

When the pipe diameter is decreased by accumulations the roughness will be increased and the friction factor

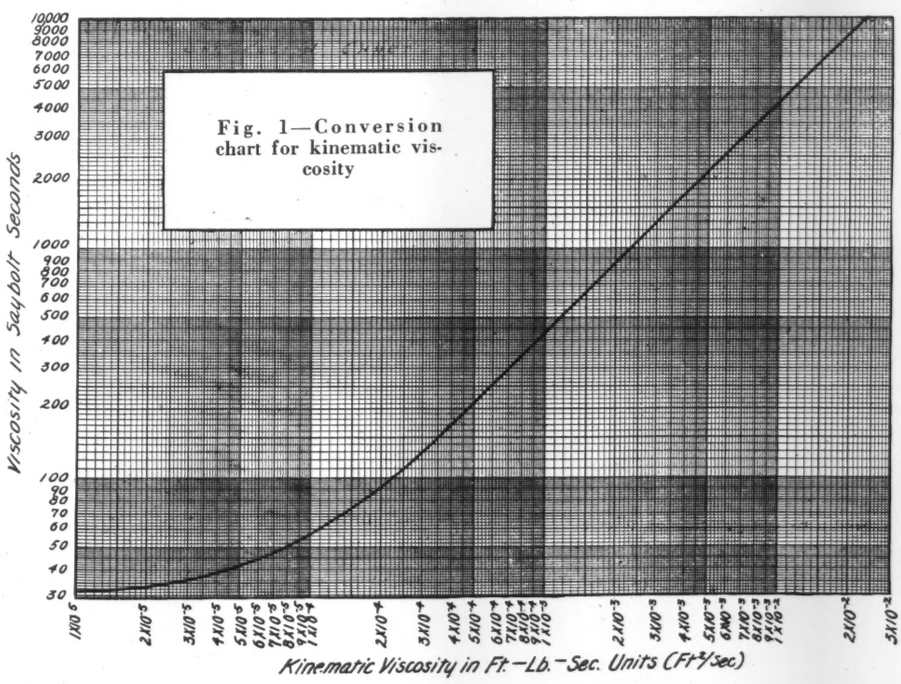
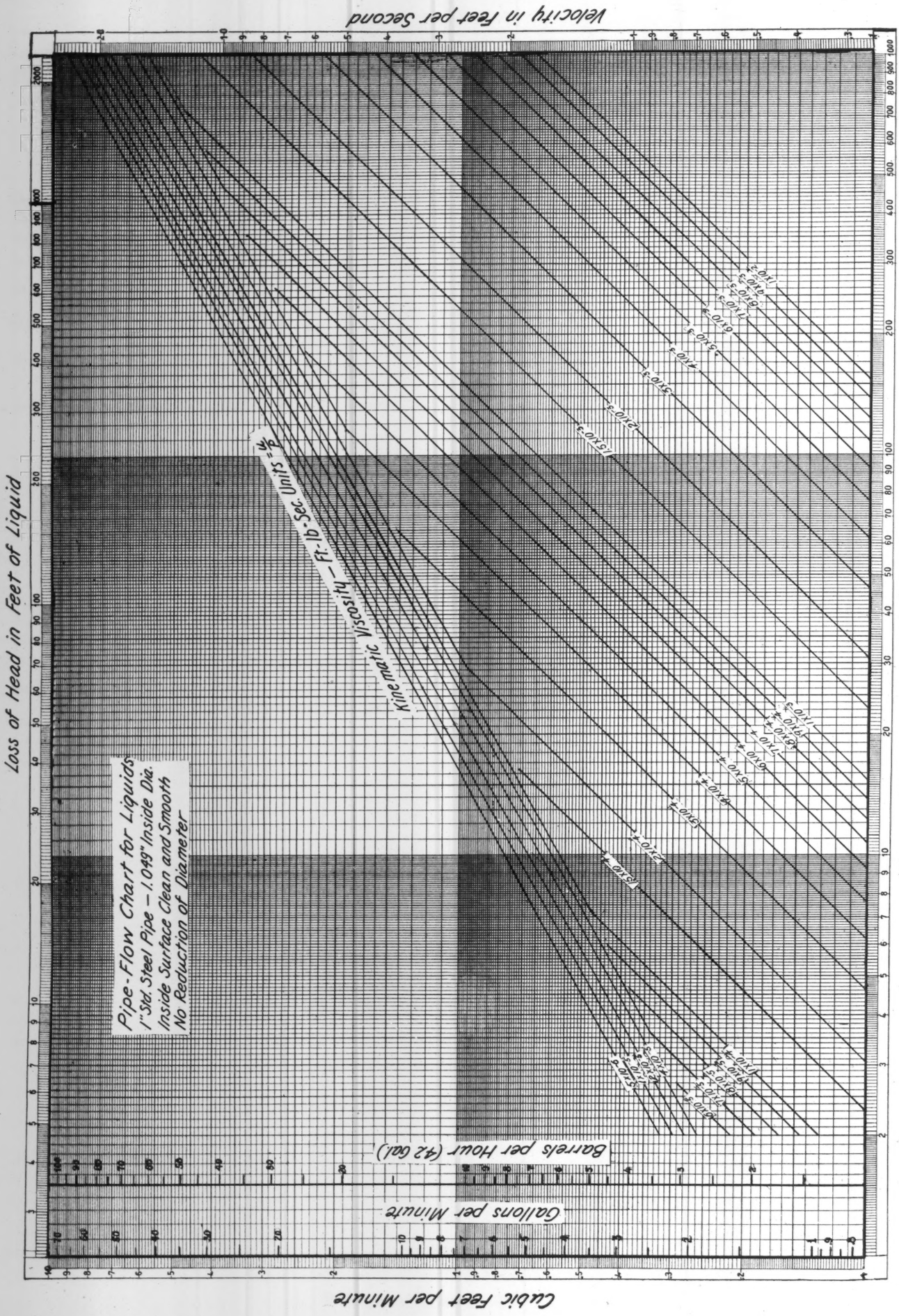
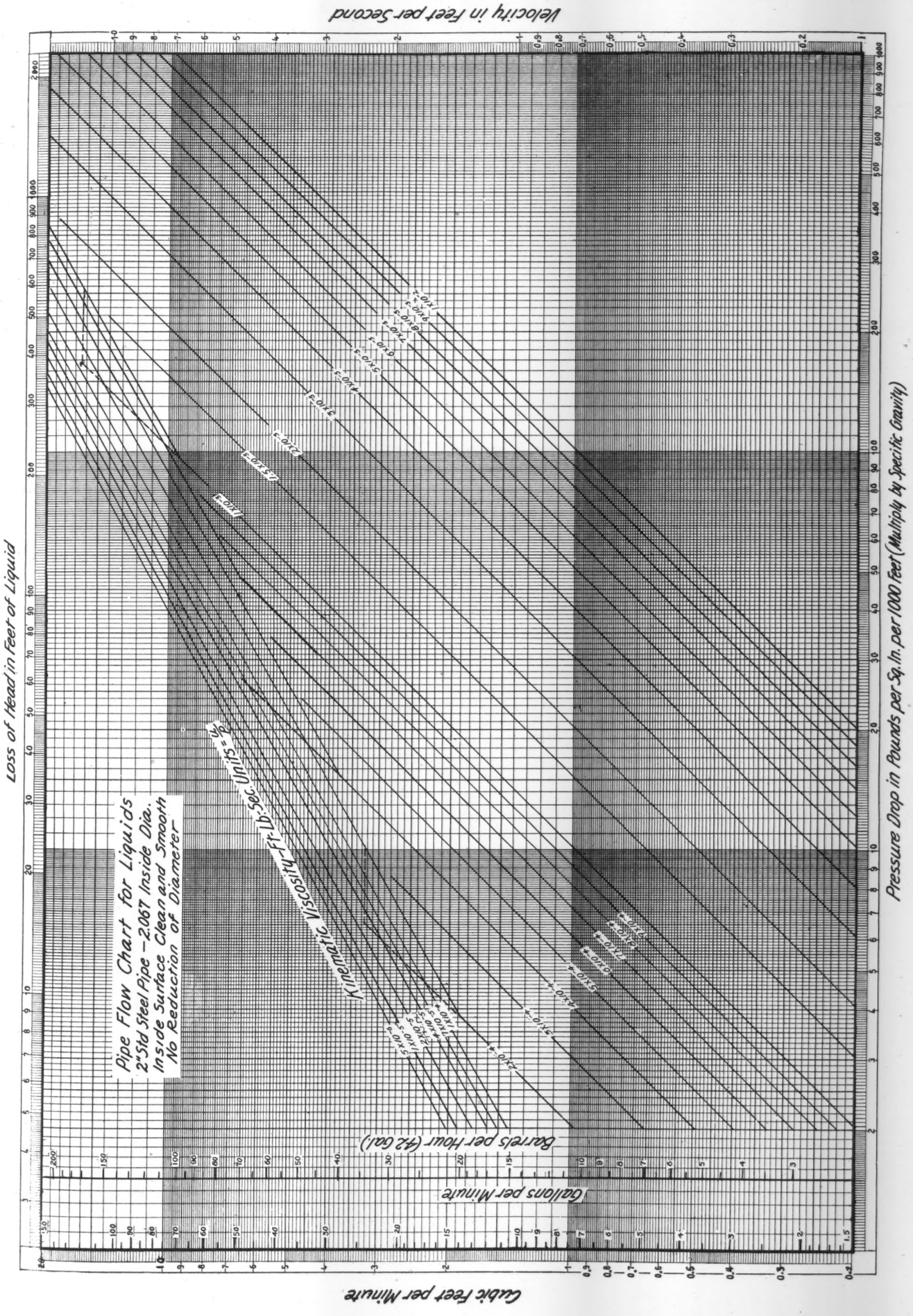


Fig. 1—Conversion chart for kinematic viscosity

By **Emory Kemler***

*University of Pittsburgh, Pittsburgh, Pa.


Velocity in Feet per Second
Loss of Head in Feet of Liquid
Pipe-Flow Chart for Liquids
1" Std. Steel Pipe — 1.049" Inside Dia.
Inside Surface Clean and Smooth
No Reduction of Diameter
Kinematic Viscosity — Ft.-lb.-Sec. Units = μ/ρ
Pressure Drop in Pounds per Sq. In. per 1000 Feet
(Multiply by Specific Gravity)
Barrels per Hour (42 Gal.)
Gallons per Minute
Cubic Feet per Minute


Velocity in Feet per Second
Loss of Head in Feet of Liquid
Pressure Drop in Pounds per Sq. In. per 1000 Feet (Multiply by Specific Gravity)
Pipe Flow Chart for Liquids
2" Std Steel Pipe – 2.067 Inside Dia.
Inside Surface Clean and Smooth
No Reduction of Diameter
Kinematic Viscosity-Ft-Lb-Sec Units = ν
Barrels per Hour (42 Gal)
Gallons per Minute
Cubic Feet per Minute

will likewise be increased. This increase is variable and will depend upon the Reynolds' number as well as the roughness. For new pipes it was found that at the higher Reynolds' numbers, the variations from the average value were as much as 10 per cent. For rough conduits such as rusty or corroded pipes the friction factor may approach the value for the hypothetical rough pipe discussed in the previous articles. The easiest and most reasonable method of determining the pressure drop is to calculate the pressure drop for a new pipe and correct the value for the estimated accumulations and increased roughness.

Gibson[1] says that the engineer who predicts within 10 per cent the discharge from a pipe has every reason to be satisfied with his choice of constants. Rhodes[2] says that pipe lines as installed show variations of ± 25 per cent from the predicted values. The experience of these authorities shows that one should not expect too close a correlation between the calculated and actual results.

Turbulent Flow

The variations that might be found in the region between the upper and lower critical numbers have been indicated on the chart for 2-in. pipe. This region is one of uncertainty and in order that the pressure drops calculated will always be on the side of safety the friction factor for turbulent flow has been used above Reynolds' numbers of 1160. The value for viscous flow in this region is shown by dotted lines. In cases where the flow falls in the region between a Reynolds' number of 1160 to 2,000 the pressure drop will in every case be larger than the actual value. If a more exact calculation is desired the formulas given in the previous articles should be used.

Fig. 1 has been included to convert viscosity in Saybolt seconds to ft-lb-sec units. This chart gives kinematic viscosity in the units used on the large charts, kinematic viscosity being defined as the absolute viscosity divided by the density. For example a viscosity of 170 Saybolt seconds equals 4×10^{-4} for the kinematic viscosity in ft-lb-sec units (ft^2/sec).

Example of Use

To illustrate the use of the chart consider that it is desired to find the pressure drop when two cubic feet per minute of oil having a viscosity of 170 Saybolt seconds and a specific gravity equal to 0.90 flows through a 2-in. standard pipe. From the chart it is seen that 2 cfm = 15 gpm and corresponds to a velocity of 1.43 ft per second. The kinematic viscosity will be found to be 4×10^{-4} ft^2/sec. Tracing across to the 4×10^{-4} line and down shows the pressure drop to be 8.15 lb per sq in. per 1,000 ft for unit specific gravity or $8.15 \times 0.9 = 7.34$ lb per sq in. for this oil.

If the flow is 5 cfm for this oil the flow will be in the critical range. The pressure drop for viscous flow as shown by the dotted line will be $20.5 \times 0.9 = 18.5$ lb per sq in. per 1,000 ft and for turbulent flow will be $25.6 \times 0.9 = 23.0$ lb per sq in. per 1,000 ft.

[1] Gibson, "Hydraulics and Its Applications," p. 208.
[2] "Hydraulics," *Trans. A. S. M. E.* Vol. 55, No. 10; Aug. 31, 1933, p. 26.

Unit Heaters a Production Aid—

(*From page* 512)

Several process uses of unit heaters in packing plants were briefly described in the May, 1933, HEATING, PIPING AND AIR CONDITIONING. One case concerned the use of a unit heater for dissipating steam rising from a hog dehairing machine and obscuring the vision of the workmen. In another case, a unit heater installed in a smoke house resulted in lower handling costs, cut the time required, and improved the product, over the method formerly used.

Units Speed Paint-Drying

C. W. Dexter (Ilg Electric Ventilating Co.) calls attention to an installation of his company's units for quick drying of newly-painted truck bodies. In this case (shown in an accompanying view) the object was to speed up the drying in order to increase the production with given paint-room equipment. A specially-constructed canvas room is used to confine the heated air and has worked out "very satisfactorily."

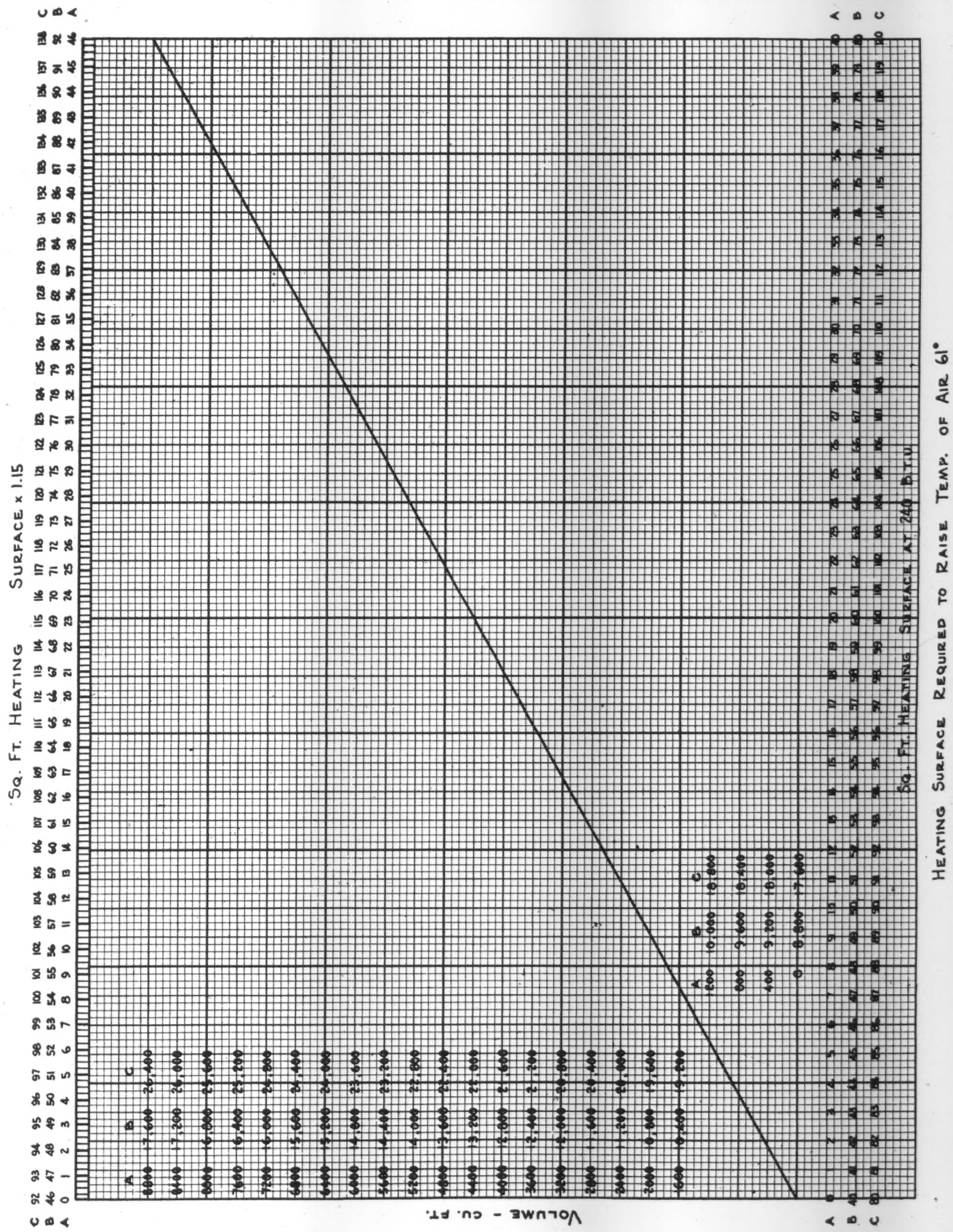
Before the installation of these two unit heaters, a truck would be driven into the painting room and spraying started at 11:00 a. m. Upon completion of the spraying, the body would have to remain until the following morning before delivery could be made. The drying was not considered complete until well along into the early morning hours. With the present system, the truck is driven into the spraying room at 11:00 a. m.; the heaters are turned on at 12:00 noon and at 2:00 p. m. the truck is hauled out sufficiently dry to prevent any dust settlement after leaving the spraying room. This allows another truck to be driven in and work started. The first truck is ready for delivery by 3:00 p. m. The second truck going through the same schedule is, therefore, ready for delivery by 6:00 p. m. In other words, production possibilities are doubled.

A similar example was mentioned in an article in last month's issue; in the plant of a manufacturer of kitchen utensils of various kinds, four 259,000-Btu units are used for the quick drying of the enameled utensils, necessary to maintain the production rate. With the units, this drying is accomplished so that the speed reached in other steps in the production process is maintained in the drying.

Among the miscellaneous applications of Buffalo Forge Company's unit heaters mentioned by F. B. Stubinger is their use in drying cabinets; the heating coils and fans being enclosed in a compact casing usually installed as a unit, make them ideal for this. Many dry-cleaning plants utilize these units for quick drying of garments, it is stated.

Calculating Heating Surface for Buildings 7

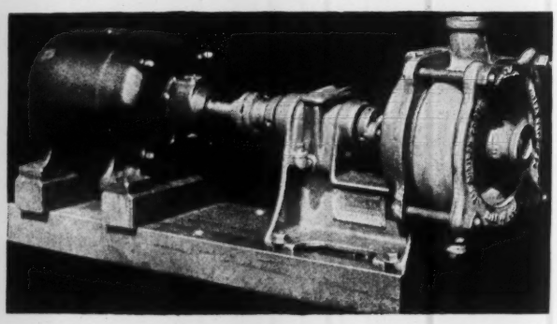
. . . . by Price L. Rogers, Consulting Engineer, Philadelphia, Pa. This is Chart No. 7 of a series designed to enable computations for heat losses from buildings to be made accurately, with a minimum of time and with decreased possibility of errors. Chart No. 1 and an explanation of the series and its use was published in April; Chart No. 2, May; Chart No. 3, June; Chart No. 4, July; Chart No. 5, August; Chart No. 6, last month.



INTERESTING Equipment..... Developments

Pump for Corrosive Chemicals

A new centrifugal pump for handling corrosive chemicals, the smallest ever built by them, is announced by The Duriron Company, Inc., Dayton, Ohio. It has a 1-in. suction, 1-in. discharge, and at 1750 rpm, the head and capacity range from 2½ gpm at a 25-ft head to 25 gpm at a 5-ft head, with power consumption varying from approximately ¼ hp to less than ½ hp, these figures being based on water. It is available in either belt or direct motor drive, and has a closed-type impeller.



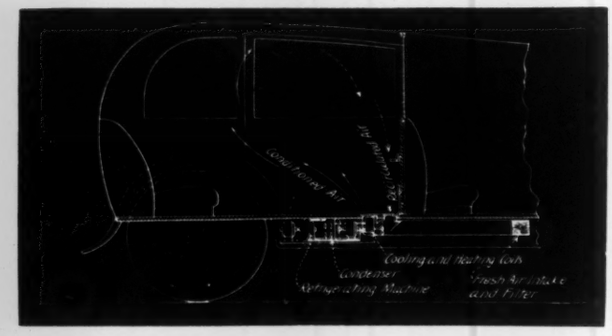
The pump is procurable in Duriron (for general acid service), Durichlor (for hydrochloric acid), Durimet (low-carbon nickel-chromium-silicon alloy steel for weak sulphuric acid at all temperatures), Durco Alloy Steels (low-carbon "18-8"—KA2S and KA2SMo), Alcumite (copper-aluminum-iron alloy for weak sulphuric acid), and in the chemical lead alloys.

Though the announcement is just being made, several of the pumps are in service as laboratory pumps, in pilot plants, and a considerable number are being used on small plating jobs.

Air Conditioning Applied to Automobiles

The Campbell Metal Window Corporation, 1 Pershing Sq., New York City, has developed an air-conditioning unit that can be installed in an automobile. The sketch shown here is from one of the patent drawings.

Air is brought into the car through two ducts on each side equipped with filters to remove dirt and dust. The air is cooled in summer and heated in winter. The compressor is air-cooled and is driven by a generator which is driven by the engine through an arrangement permitting proper speed despite the speed of the car. The fans are also driven by this equipment. Heating is done with hot water.

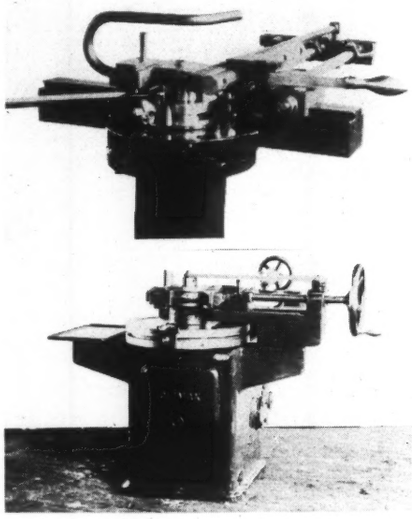


The equipment was applied to an experimental car by John A. Sargent of Campbell Metal Window Corporation recently. The first applications are expected to be to buses, taxis, etc., and the higher-priced private cars.

New Tube-Bending Machine

A new tube-bending machine is now being offered by the Schatz Manufacturing Co., Poughkeepsie, N. Y., in hand- or motor-driven types for bending steel and non-ferrous tubes and pipes, the largest being for steel tubes up to 8 in. O.D. and non-ferrous tubes up to 10 in. O.D. The machine in the upper view is hand operated and has capacity for bending up to 1-3/16 in. O.D. steel and 1-9/16 O.D. non-ferrous tubes. That illustrated in the lower view is motor driven and bends up to 2½-in. steel and 3-in. non-ferrous tubes, using a 3-hp motor.

The machines make bends cold, without filling, and have a patented mandrel and machine release, according to the makers. When the material lends itself, the machines can bend a radius down to about one to two times the outside diameter of the tube, radius measured to the center of the tube. Performance on the hand-operated type shown is approximately 60 to 80 bends per hour. Right- or left-hand bends can be made. All segments are arranged to bend from 0 to 180 degrees, and a finely graduated gage assists in accurate bending. Special segments can be furnished for making bends that run into one another.

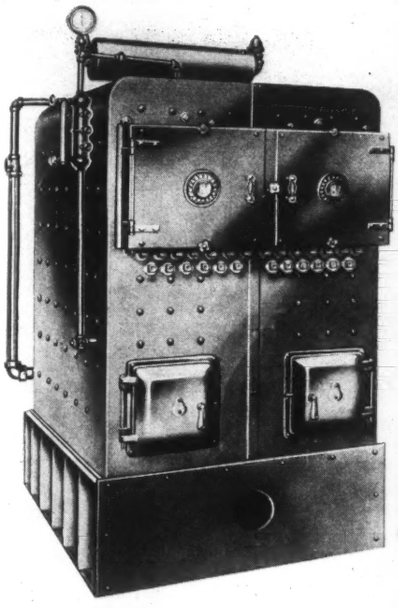


The two largest motor-driven models have two working speeds and accelerated return of the segment to the original starting position. Machines are built strongly enough to bend *S.A.E. 4130* steel tubes and annealed Allegheny Metal tubes.

Oil-Burning Steel Boiler Announced

Spencer Heater Company, Williamsport, Pa., has recently announced a new oil-burning steel boiler, in capacities from 2,250 to 40,000 sq ft.

The boiler is ruggedly built of ⅜-in. *A. S. M. E.* flange boiler quality steel, and with special-analysis cooper-bearing *A. S. M. E.* tubes. The large combustion chamber is so designed that the



heavier grades of oil may be burned smokelessly. Long gas travel and large heat-absorbing surfaces correctly proportioned promote efficiency. Any standard make of oil burner may be used.

The two piece method of construction facilitates handling and installation, and the boilers up to 14,000 ft capacity will go through a 3-ft door opening. The combination water tube and fire tube design makes it an economical boiler, and the welded steel construction eliminates any possibility of breakdown, according to the maker.

Recording Thermometer and Pressure Gage

A new and improved line of 8 and 12 in. circular-chart instruments has been placed on the market by The Brown Instrument Company, Philadelphia, Pa. These instruments include thermometers in indicating and recording types for temperatures from —40 F up to 1200 F, and indicating or recording pressure and vacuum gages for ranges from 10 in. of water up to 5,000 lb. All types are offered in one-, two- or three-pen models.

The mercury-filled helix is built of a special stainless steel to withstand 100 per cent overload and provide a surplus of power to move the pen. The gas- and vapor-type helices are made of heat-treated phosphor bronze for increased ruggedness and power These thermometers may be located at distances up to 200 feet.

In the pressure and vacuum gauges, three different types of actuating movements are employed. For ranges 10 in. of water to 30 lb, a flexible metal diaphragm is used. For ranges 30 and 200 lb, a spring-opposed bellows has been developed. For pressures over 200 lb, a helix is used.

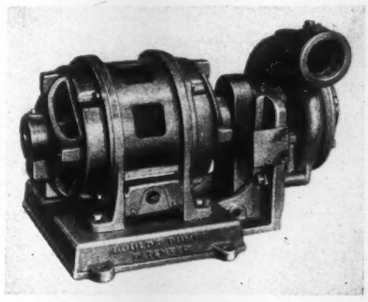
An electric clock eliminating daily hand winding, is standard. Where a-c current is not available, hand-wound clocks are furnished. Cases are of die cast non-corrosive aluminum and are interchangeable for back or bottom connection or for flush panel mounting, permitting flexibility in installation.

Several other features are included and are described in detail in a recently-issued bulletin.

New Motor-Centrifugal Pumping Unit

A new motor-centrifugal pumping unit just announced by Goulds Pumps, Inc., Seneca Falls, N. Y., has been designed to be compact, have high efficiency, and to be low in cost. A new close-coupled type of mounting is used which permits the use of standard motors without special bedplates and brackets. The pump bedplate extends under the motor to relieve it of excessive strains.

These pumps are built in sizes ¾ to 4 in. for capacities up to 1000 gpm. Heads range from 10 to 290 ft. A complete description, with a selection chart for both the 1750 and 3550 rpm speeds, is given in a bulletin recently published.



The applications of these pumps in heating, piping and air conditioning are many and varied.

Unloader For Small Compressors

A new ¾-in. instantaneous unloader for ammonia compressors, recently made available by the Electric Machinery Mfg. Co., Minneapolis, Minn., is illustrated here. The "¾ in." refers to the size bypass for which the unloader is suited.

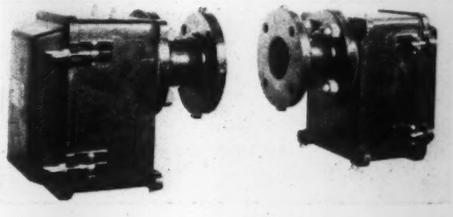
The instantaneous-unloader is an automatic pressure-differential-operated bypass valve connected between the suction and discharge on the compressor. The valve operates by gas pressure differential and is controlled by a magnet pilot valve which in turn is controlled by the frequency responsive relay on the motor-starting panel.

When the motor is started, the pilot valve is energized and a small amount of high-pressure ammonia gas is admitted to the unloader to actuate it. This gas is returned to the low-pressure side of the system so there is no leakage or waste. No springs are used and the mechanical construction is simple.

Automatic start-and-stop operation of the compressor units can be secured with use of the instantaneous unloader, the compressors starting and stopping by brine thermostats, suction pressure control or other means to maintain desired temperatures. Freedom is provided from shut-downs due to power disturbances; the unloader keeps the compressor running through momentary "voltage-dips."

Smoke Density Indicating and Recording

Photo-electric equipment for indicating and recording the degree of density of smoke passing through the stacks or breechings of heating and power plants has been announced by the General Electric Company, Schenectady, N. Y. Changes in smoke density are indicated on a meter. A running record of the amount of smoke passed up the stack may be obtained by the addition of a recording instrument.



The essential elements of the apparatus are a light source and a photo-electric relay unit. The recording instrument is optional.

The photo-electric unit and the light source are designed for mounting on opposite sides of the stack so that the light beam from the light source passes through the stack and falls on the phototube. When there is no smoke in the stack the full intensity of the light is directed on the phototube and the indicating or recording instrument will register zero smoke density. As the smoke density increases, the phototube receives less light from the source and the instrument indicates or records the increase of smoke.

Lenses are provided in front of the phototube and light source. Clean air is drawn by the induced draft of the stack across the lenses, which assists in keeping them clean. The lenses require some cleaning, however, and therefore the apparatus has been designed so that the lenses are easily accessible.

The light source and photo-electric relay unit are enclosed in cast-iron cases for durability and protection against dust and moisture. Cases are provided with heavy flanges for mounting on the stack. An adjustable electrical contact for operating an alarm circuit is provided which can be adjusted to any point between 20 to 60 per cent of full smoke density. Adjustment can be made by the use of a screwdriver.

Another development recently announced by this company is an oil-immersed, combination switch for use in Class I, Group D hazardous gas locations. The switch is available in three sizes for motors up to 50 hp at 440 volts. It is suitable for use in paint factories, lacquer plants, oil refineries, chemical houses, and in other places where it might be exposed to corrosive and explosive gases. Inasmuch as the device is of weather-proof construction, it may be located outdoors if necessary.

The combination switch consists essentially of three parts: a magnetic switch, a motor circuit switch, and a thermal overload relay which is reset by a plunger extending through the top cover. These parts, together with all connections, are located six inches below the surface of the oil in an oil-filled tank of welded construction. The tank, which is welded from heavy sheet steel, is supported from the top cover by four wing bolts. Handles on the sides of the tank facilitate its removal.

G. E. has also developed an inexpensive, direct-acting reclosing device for use with oil circuit breakers. This attachment will enclose a breaker one, two, or three consecutive times, with equal time intervals between reclosures, when the breaker is tripped by overload. If the overload disappears after any reclosure, the attachment will return to its normal position and the breaker will remain closed. If the overload still exists after the last reclosure, the breaker will remain locked open and it will be necessary to close it manually before any further automatic operation takes place.

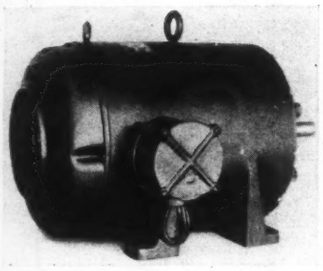
The attachment is a mercury-tube device in which timing is obtained by running mercury through an orifice into a reclosing contact chamber.

Among the features of a new line of rectangular switchboard instruments which has also been announced by General Electric is the fact that the scale can be read at an angle with no error of parallax. Anti-glare glass is a special feature. Others are magnetic damping, high torque, responsiveness, permanently constant characteristics, and availability in three styles of cases.

The line includes alternating current voltmeters, ammeters, wattmeters, power-factor meters and frequency meters, and direct-current ammeters and volt-meters. Special instruments also available include temperature meters and radio-frequency and rectifier type instruments.

Totally-Enclosed Fan-Cooled Motor Announced

The Ideal Electric & Manufacturing Company, Mansfield, Ohio, has developed a new totally-enclosed, fan-cooled motor, a fully protected motor with dust-tight construction the same size as an open-type motor of same rating. Protection is provided against



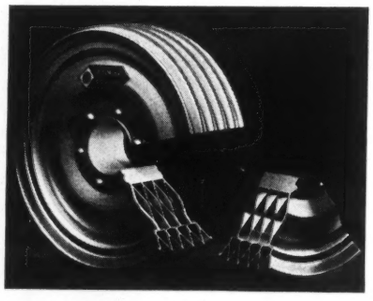
explosive dust, abrasive dust, corrosive gases or fumes, current-carrying dust, and steam or moisture. The motor is especially suited for use in steel mills, metal-working plants, foundries, packing plants, grain elevators, flour and feed mills, chemical plants, laundries, etc.

The construction employs two shells, the inner shell being dust tight and enclosing windings and rotor. Tight sealing is obtained by machined metal-to-metal stationary joints with long close fits —no running seals. A fan mounted outside this shell forces a blast of air between the inner shell and the outer one, providing cooling.

These motors are made in all sizes from 1 to 200 hp as squirrel-cage induction motors to meet all classifications of torque and inrush requirements and with 1, 2, 3 or 4 speeds. They are available also as across-the-line-start motors up to 200 hp and can be supplied for power-factor correction as 100 per cent or 80 per cent leading-power-factor induction motors in all sizes.

Increase in Drive Ratings

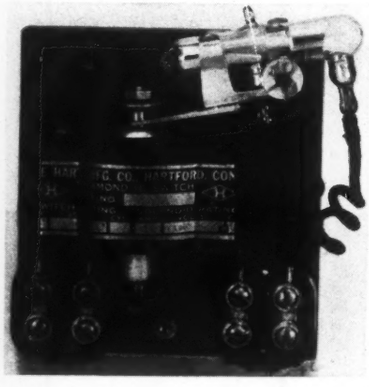
Allis-Chalmers Texrope V-belt drive with one or both sheaves "Texsteel" are now available from ¼ to 15 hp suitable for many industrial applications, according to a recent announcement. Texsteel sheaves are grid-type construction, as illustrated, with accurately-formed heavy-gage steel sections electrically welded at web and rim. Outer rims are rolled for protection, appearance and strength. Integral bushings or solid bored hubs are standard. The sheaves are well-balanced, sturdy but light in weight, and have an attractive aluminum finish.



Mercury-Tube Relays

New mercury-tube relays (20 amp, 250 volts; 30 amp, 125 volts) made by The Hart Mfg. Co., Hartford, Conn., have been designed for controlling loads as mentioned by means of a low amperage secondary circuit. The coils are of the continuous current type, wound for 110 or 220 volts, a-c or d-c. Special coils as low as 6 volts d-c may be supplied.

These relays are used for controlling automatic machines and signal systems, temperature control on many kinds of industrial equipment, and for a number of other special uses. They are made in single, double, triple and four-pole types, and single pole-double throw and double pole-double throw.



Solenoid windings are designed for continuous operation and can be controlled by any suitable single-pole switch. No open arc is made because current is broken by the mercury tube. Coil consumption is 8 watts.

(To page 67, back section)

Heating · Piping
and Air Conditioning

American Society of Heating and Ventilating Engineers JOURNAL SECTION

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1927 Rosemont Rd., East Cleveland, O.

CINCINNATI
Headquarters, Cincinnati, O.
Meets: Second Tuesday in Month
President, K. A. WRIGHT
1113 Race St.
Secretary, G. B. HOULISTON
704 Race St.

ILLINOIS
Headquarters, Chicago
Meets: Second Monday in Month
President, J. H. O'BRIEN
228 N. LaSalle St.
Secretary, J. J. HAYES
53 W. Jackson Blvd.

KANSAS CITY
Headquarters, Kansas City, Mo.
Meets: Second Monday in Month
President, DAVID CALEB
1330 Baltimore Ave.
Secretary, C. A. WEISS
1811 Troost Ave.

MASSACHUSETTS
Headquarters, Boston
Meets: Second Monday in Month
President, LESLIE CLOUGH
Box 34, Weymouth, Mass.
Secretary, E. W. BERCHTOLD
100 Arlington St.

MICHIGAN
Headquarters, Detroit
Meets: First Monday after the 10th of the Month
President, H. E. PAETZ
2539 Woodward Ave.
Secretary, TOM BROWN
487 W. Alexandrine Ave.

WESTERN MICHIGAN
Headquarters, Grand Rapids
Meets: Second Monday in Month
President, K. L. ZIESSE,
115 Campau Ave.
Secretary, P. O. WIERENGA,
49 Coldbrook St., N. E.

MINNESOTA
Headquarters, Minneapolis
Meets: Second Monday in Month
President, A. B. ALGREN
3049 10th Ave. S.
Secretary, C. E. GAUSMAN
2360 Chilcombe, St. Paul, Minn.

NEW YORK
Headquarters, New York
Meets: Third Monday in Month
President, H. L. ALT
65 Fourth Ave., Newark, N. J.
Secretary, T. W. REYNOLDS
109 West 96th St.

NEW YORK UNIVERSITY STUDENT CHAPTER
Headquarters, New York University
President, HERBERT MAIMAN
78-65 80th St., Glendale, L. I., N. Y.
Secretary, ABRAHAM RAFFES
977 East 178th St., New York, N. Y.

WESTERN NEW YORK
Headquarters, Buffalo
Meets: Second Monday in Month
President, D. J. MAHONEY
503 Franklin St.
Secretary, W. E. VOISINET
250 Delaware Ave.

ONTARIO
Headquarters, Toronto, Can.
Meets: First Monday Every Other Month
President, W. P. BODDINGTON
106 Lombard St.
Secretary, H. R. ROTH
1104 Bay St.

PACIFIC NORTHWEST
Headquarters, Seattle, Wash.
Meets: Second Thursday in Month
President, P. M. O'CONNELL
5749 31st Ave. N. E.
Secretary, S. D. PETERSON
5051 Prince St.

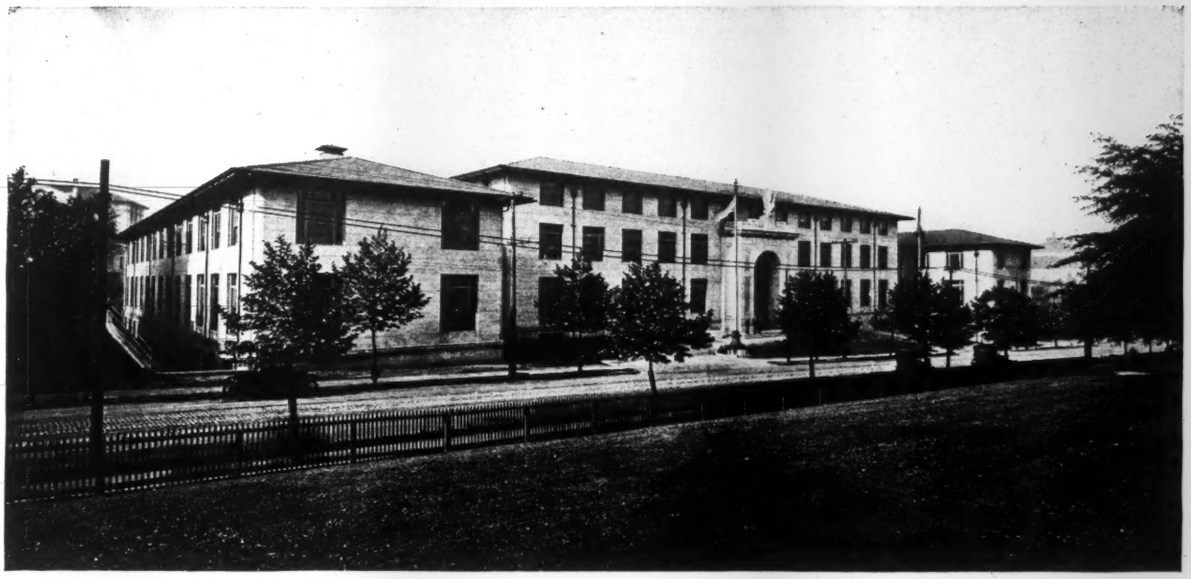
PHILADELPHIA
Headquarters, Philadelphia
Meets: Second Thursday in Month
President, M. F. BLANKIN
1518 Fairmount Ave.
Secretary, W. R. EICHBERG
4210 Sansom St.

PITTSBURGH
Headquarters, Pittsburgh
Meets: First Monday in Month
President, G. S. MCELLROY
R. D. 2, Glenshaw, Pa.
Secretary, I. L. BLACKSHAW
3728 Dawson St.

ST. LOUIS
Headquarters, St. Louis
Meets: First Wednesday in Month
President, C. A. PICKETT
2628 Olive St.
Secretary, C. R. DAVIS
2328 Locust St.

SOUTHERN CALIFORNIA
Headquarters, Los Angeles
Meets: First Tuesday after the 10th of the Month
President, L. H. POLDERMAN
748 E. Washington St.
Secretary, E. H. KENDALL
1224 S. San Pedro St.

WISCONSIN
Headquarters, Milwaukee
Meets: Third Monday in Month
President, V. A. BERGHOEFER
4080 N. 24th St.
Secretary, C. H. RANDOLPH
918 N. Van Buren St.



Pittsburgh Experiment Station of the U. S. Bureau of Mines where the Research Laboratory of the American Society of Heating and Ventilating Engineers is Located

Radiation of Energy Through Glass

By **J. L. Blackshaw* and F. C. Houghten† *(MEMBERS)***

Pittsburgh, Pa.

DURING discussion at the annual meeting of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS held in Pittsburgh in 1931, an interesting point was brought up concerning the transmission of heat through glass by radiation from low temperature surfaces. Surprising to many was the statement that radiation from such comparatively low temperature sources as steam or hot water radiators and the surfaces of room furnishings does not pass through glass. This idea appeared to contradict earlier Laboratory data,[1] which showed that glass absorbs only about 10 per cent of the solar radiation incident to it, and to suggest that the glass windows of a building would act as heat traps because they would allow most of the radiant energy from the sun to pass into the building, but would not permit radiant energy from inside surfaces to pass out.

At the next annual meeting, a paper by Miller and Black[2] was presented supporting the points brought up a year earlier, giving the underlying physical data of radiation and concluding that there is practically no loss of radiant energy from low temperature sources directly through windows.

At the Cleveland Heating and Ventilating Exposition, the Laboratory demonstrated with its pyrheliometer the variation in radiation intensity caused by different temperatures of the source, and the effect of intervening glass in obstructing such radiation. It was suggested that this set-up was adaptable for further check on the absorbing qualities of glass for low temperature radiation, and the Laboratory was asked to make such a study.

The pyrheliometer and auxiliary equipment used by the Laboratory in this study are shown in Fig. 1. The pyrheliometer, which is fully described in a previous Laboratory paper,[3] has as its heat sensitive element a light weight, blackened copper disc, to which the hot junctions of a thermocouple series are attached, their cold junctions being clamped in the flanged edge of a surrounding brass cup, kept at constant temperature by a water bath. A water-cooled shield in which a small aperture was centered was placed between the radiating source and the pyrheliometer. This aperture and a second one close to the sensitive disc limited the amount of energy reaching the disc to a small cone. Glass or opaque slides could be slowly moved across the cone,

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†Director, AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS Research Laboratory, Pittsburgh, Pa.

[1]Absorption of Solar Radiation in Its Relation to the Temperature, Color, Angle and Other Characteristics of the Absorbing Surface, by F. C. Houghten and Carl Gutberlet. A. S. H. V. E. TRANSACTIONS, Vol. 36, 1930, p. 137.

[2]Transmission of Radiant Energy Through Glass, by R. A. Miller and L. V. Black. A. S. H. V. E. JOURNAL SECTION, *Heating, Piping and Air Conditioning*, February, 1932, p. 143.

[3]Heat Transmission as Influenced by Heat Capacity and Solar Radiation, by F. C. Houghten, J. L. Blackshaw, E. M. Pugh and Paul McDermott. A. S. H. V. E. JOURNAL SECTION *Heating, Piping and Air Conditioning*, April, 1932, p. 292.

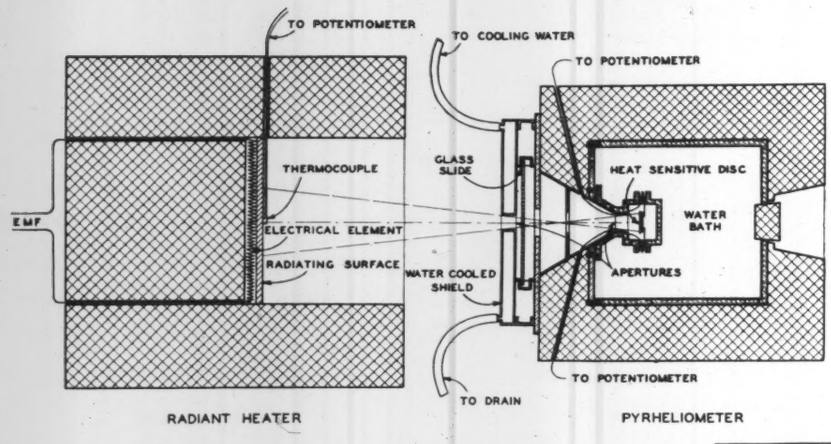


Fig. 1—Apparatus for Determining Transmission of Radiation Through Glass

close to the water-cooled shield, but between it and the sensitive disc, so that insufficient time was allowed for the small portion of exposed glass to warm up and re-radiate to the sensitive element. All surfaces between the water-cooled shield and the sensitive disc were smoked to minimize the reflection of radiated energy. Hence, only that portion of the total radiation from the heated surface which passed through the apertures and was not absorbed by the glass reached the sensitive disc.

In the test set-up of Fig. 1, the source of radiant energy was a 6-in. square of ¼-in. unfinished boiler plate, which could be heated by an electrical element to any constant temperature up to a ruddy glow, or 1200 F. Since ordinary wall surfaces and objects found in a room radiate approximately as black bodies, a rough steel surface was used as a source of energy, because work[4], [5] done on such a surface has shown its emissivity to be about 95 per cent of that of a black body. The heat emission in Btu per square foot per hour was calculated from potentiometer readings of the pyrheliometer through the use of a calibration curve derived from the calculated heat emission of the steel plate at different temperatures. This calibration checked to within 19 per cent an extrapolation of a previously established calibration curve for high temperature radiation from the sun determined with a Smithsonian Institution silver disc pyrheliometer. This difference may be accounted for by a change with time in the calibration of the pyrheliometer, or by an error in extrapolating the solar radiation curve to permit its use for low temperature radiation.

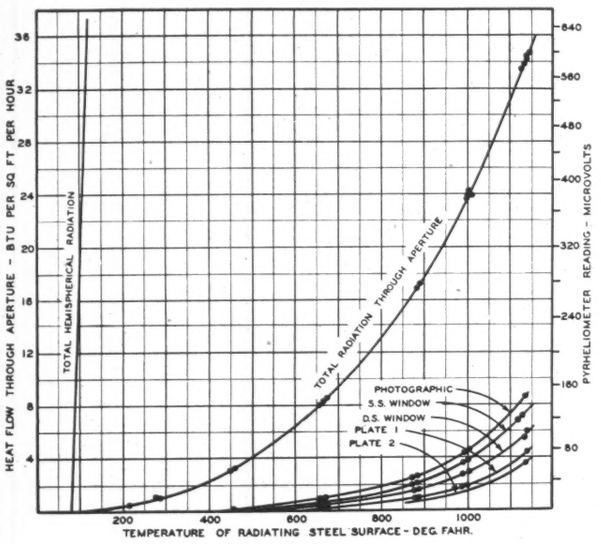
For other tests, an electric arc and banks of incandescent tungsten and carbon filament bulbs were used as energy sources. When incandescent bulbs were used the apparatus was so arranged that the heat sensitive disc was sighted on a group of the filaments. For these other tests the calibration curve could not be employed. No attempt was made to take into account the wave length distribution of the radiation from different sources.

In order to eliminate stray radiation when making a test, the room in which the equipment was located, the water-cooled radiation shield, and the bath of water in the pyrheliometer were all held constant at 80 F.

[4]Transmission of Heat Through Insulation, by R. H. Heilman. *Mechanical Engineering*, July, 1930, Vol. 52, No. 7, p. 693.

[5]Mark's *Mechanical Engineers Handbook*, 3rd Ed., (1930). Table 11, p. 409.

Fig. 2 (Below) — Relation Between Temperature of Rough Steel Radiating Plate and Radiation Through Unobstructed Aperture and Through Various Kinds of Glass. Receiver and Surroundings at 80 F



When the temperature of the radiating source had been adjusted and maintained at the desired point, a routine of tests was made: First, a blackened opaque shield gave a check on the zero of the instrument; then, the shield was removed to permit a reading of the total radiation from the source; next, various samples of glass were slid behind the aperture, and potentiometer readings of the pyrheliometer were taken to indicate the radiant energy which passed through the glass. Periodic tests with opaque slides and with unobstructed radiation kept a check on the instrument. Table 1 lists the various types of glass samples used.

Results of tests made with hot rough steel as a source of radiation are given in Fig. 2, where temperatures of the steel in degrees Fahrenheit are plotted as abscissae and rates of radiant heat flow to the disc, for various types of glass, are plotted as ordinates in Btu per square foot per hour. Potentiometer readings, in microvolts, are shown on an auxiliary ordinate scale. The results given in Fig. 2 are for test conditions where only a part of the total radiation from the surface passed through the aperture in the water-cooled shield, and the Btu values plotted apply only to the particular arrangement of the equipment and apparatus used in these tests. The curves in Fig. 2 are all based on an absorbing surface temperature of 80 F. It may be seen from these curves that no radiation passed through any of the types of

glass tested until the radiating surface had reached 410 F, when a perceptible amount began to register through the photographic specimen. Radiation did not begin to pass directly through plate glass until a temperature of about 550 F was reached. At 1000 F, when the radiating plate was just beginning to glow, it may be seen from the curves that there was no great amount of energy transmitted by any of the glasses.

The almost vertical curve in Fig. 2 shows the total hemispherical radiation from the hot plate in Btu per square foot per hour for the different temperatures. This curve was calculated from the Stefan-Boltzmann law with an assumed emissivity constant for the steel surface of 0.95. At a steam radiator temperature, 212 F, the total hemispherical radiation is 190 Btu per square foot per hour, but at this temperature there was no evidence of radiation passing through the glass samples studied.

Data from Fig. 2 may be easily converted to percentages of the total energy radiated through the glass. Such percentages show that when the steel was glowing at a temperature of 1100 F, only 23 per cent of the total radiation passed through the thinnest of the glasses tested. The radiant rays all fell within 4 deg of the normal to the glass surface. Had they fallen at a greater angle, the transmission of energy through the glass would have been even less.

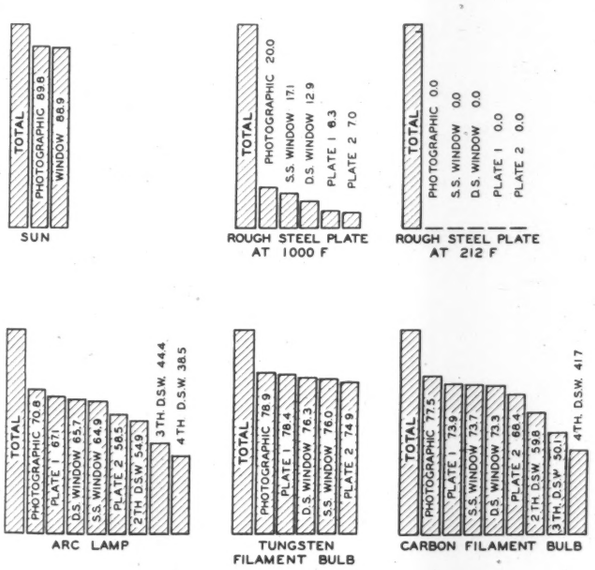


Fig. 3—Comparison of Total Radiation From Different Sources with Percentages Transmitted by Various Kinds of Glass

Column diagrams showing the results of tests made with different sources of radiant energy are given in Fig. 3, where the total radiation from each source is compared with the percentage which was transmitted through the respective types of glass. Additional data are shown in Fig. 3 for two, three, and four thicknesses of double-strength window glass when the arc lamp and the carbon filament bulbs were used. Data from earlier Laboratory papers[1, 3] included in Fig. 3 show the percentage of solar radiation transmitted through glass.

Table 1—Glass Samples

Description	Thickness, Inches	Remarks
Photographic	0.065	Clear and colorless
Single strength window	0.080	Greenish tinge
Double strength window	0.125	Greenish tinge
Plate 1	0.2655	Yellowish tinge
Plate 2	0.2390	Greenish tinge

It may be seen from Fig. 3 that the sun, the electric arc, and the electric filaments, which are sources of short wave length, high temperature radiant energy, passed the main part of their energy directly through the glass, while the heated rough steel plate, simulating conditions of low frequency radiant energy in the infra-red range, did not transmit a great amount of energy through glass. Because the steel surface transmitted no registerable energy at temperatures less than 410 F, it is deducted that no appreciable energy radiated from heating surfaces or from the furnishings of a room would pass directly through its glass windows.

Study of Fig. 3 indicates a close check between percentage of radiation for both types of incandescent bulbs. This is probably true because energy is being re-radiated from the heated glass surfaces of the bulbs, and the greater actual temperature of the tungsten filament does not have its relative effect on the total transmission. In addition, it is deducted that most of the energy from the filament that passes through the glass of the bulb itself will necessarily pass through other glass, and that, therefore, the proportional transmission from an incandescent bulb is greater than that from an electric arc.

Comparing the relative amounts of energy transmitted, as shown in Fig. 3, with the varying thicknesses of the respective glasses, listed in Table 1, it may be seen that absorption by glass is not proportional to the thickness of the glass.

Summary

The conclusions of Miller and Black,[2] that glass does not transmit low temperature radiation, are borne out. Ordinary double strength window glass transmits no measurable amount of energy radiated from a source at 500 F or lower. It transmits only 6.0 and 12.3 per cent of the total radiation from surfaces at 700 F and 1000 F, respectively. This same glass transmits 76.3 per cent of the radiation from an incandescent tungsten lamp, 65.7 per cent of the radiation from an arc lamp, and 88.9 per cent of the radiation from the sun. Thus, glass windows in a room are shown to constitute heat traps, which allow rather free transmission of radiant energy into the room from the sun to warm the objects in it, but do not allow the transmission of re-radiated heat from these same objects.

Codes! Committees! Conferences!

In the Conning Tower, F. P. A., *New York Tribune* columnist, has suggested the text for a sign to be placed on enterprising store: "In order to give most of the population, now engaged eighteen hours a day on drafting codes, in code conferences, and in acting on committees to make cities economize by asking citizens to pay more taxes, this store will be open from midnight to 8 a. m."

Selecting Temperatures and Wind Velocities for Calculating Heat Losses

By **Paul D. Close,** ***MEMBER***

Chicago, Ill.

PROBABLY the most important of all heating calculations is that of estimating heat losses. Regardless of how large or how small a building may be, some estimate of the heat to be supplied should be made if a modern heating system is to be installed. While it is a comparatively simple matter to design a heating plant of *ample* capacity to maintain the desired conditions, the difficult problem is to provide just the right amount of heating capacity, and no more, since any excess means an unnecessary increase in the cost of equipment.

The process of determining the size of heating plant required involves the equating of two quantities, namely (1) the so-called heat loss of the building or the probable amount of heat which will be dissipated from the structure for certain specified inside conditions and assumed outside conditions and (2) the heat gain or the heat to be supplied by the heating apparatus. Often, however, a factor or safety, or more properly, a "factor of ignorance," is used in the calculations to allow for quantities of unknown or doubtful magnitude, such as uncertainties of the weather, inadequate data concerning the rate of heat loss of the building structure, and doubt as to the accuracy of the assumptions under service conditions.

Factors Governing Heat Losses

There are many factors which influence or have a bearing on the loss of heat from a building. These may be broadly classified as (1) inside conditions, (2) outside conditions and (3) the building. Under *inside conditions* may be included the temperature to be maintained at a stated level, stratification of heated air due to high ceilings, type of heating system and manner of distribution, period and nature of occupancy, method of temperature regulation (whether manual or automatic), and the influence of any outside air that may be introduced for ventilating or air conditioning purposes.

Outside or *weather conditions* include temperature, direction and velocity of wind, humidity, precipitation, and percentage of sunshine; although the latter probably may be neglected in heating calculations as it is logical to assume that the period of maximum heat loss occurs when there is no sunshine. The *building* includes the size, shape, the type and quality of construction, and the physical properties of the materials used, especially the rate of heat transmission and the heat capacity thereof.

Methods of Calculation

Briefly the problem is to determine the maximum heat loss from the building for some interval of time giving consideration to the coordinated effect of all of the foregoing factors.

The first formulas for calculating heat losses such as the Carpenter, the Mills and the 4, 4, 4 rules took account only of the volume of the room or space under consideration and the area of wall and glass surfaces, disregarding the type and quality of construction and the materials used. It made no difference how well or how poorly insulated a building might be, or whether storm sash or weatherstrips were used, the same size or capacity of heating unit would be required. These rules were "satisfactory" in most cases only because they were safe. They are still used to some extent, but are not recommended except for checking purposes.

The Btu method outlined in Chapters 2, 3 and 4 of the A. S. H. V. E. GUIDE 1933, is the most accurate method of calculating heat losses at present known. In this method the heat losses are divided into two kinds namely (1) transmission losses and (2) infiltration (or exfiltration) losses. Transmission losses are those resulting from the transfer of heat by conduction through solid members of a building when a difference in temperature exists between the two sides. Infiltration losses are those resulting from the displacement of heated air in a building by unheated outside air, the interchange taking place through various apertures in the building shell such as cracks around doors and windows, fireplaces, and chimneys.

In making the calculations, certain temperatures are assumed. The inside temperature to be maintained at a given level in the room is specified. The outside temperature is assumed to be a certain number of degrees—usually 10 or 15—above the lowest temperature on record for the district in which the building is located. Special allowances are made for temperatures in unheated spaces.

The wind velocity selected for making the infiltration calculations is usually the average during the months of December, January and February. Less importance is assigned to the effect of wind velocity upon the transmission losses and usually a velocity of 15 mph is selected for all except thin, highly-conductive walls. The only effect of variations in the wind velocity upon the transmission losses is to change the heat resistance of the exterior surface; and since this resistance is ordinarily only a fraction of the total heat resistance of the wall (except for highly-conductive constructions), it is sufficiently accurate to assume a single value for practically all surfaces, as already stated. After the transmission and infiltration losses are computed for all rooms

or spaces to be heated, an additional allowance is made for rooms exposed to prevailing winds.

Discrepancies Between Actual and Computed Results

Although heat losses calculated according to the foregoing methods have been found to be reasonably accurate in the majority of cases, occasionally discrepancies arise between the actual and the computed results, particularly where unusual climatic conditions are involved and the diffusivity[1] of the construction is low. It is presumed therefore that such discrepancies may be attributed largely to (1) improper selection of temperatures and wind velocities, and (2) neglect of or improper allowance for the diffusivity of the structure. It is the purpose of this paper to discuss the selection of temperatures and wind velocities.

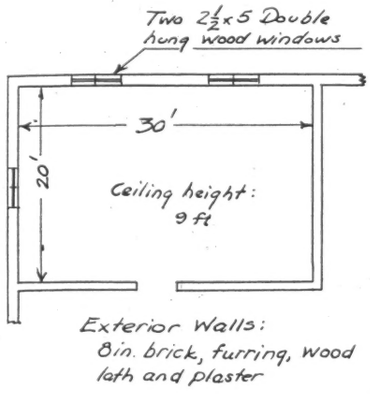


Fig. 1—Details of Room No. 1

As previously stated, the usual procedure is to select an outside temperature above the lowest recorded for a period of years in the given locality. On the other hand, the wind velocity used in calculating the infiltration losses is the average during the months of December, January and February. This wind velocity and the temperature selected are applied together in arriving at the infiltration losses and yet they may have no relationship to each other. Since the problem is to determine the worst combination of weather conditions, the two most important of which apparently are the temperature and wind velocity, it seems logical that the temperature and wind velocity selected should be those *occuring at the same time,* or the averages *during some interval of time.*

Analytical Studies of Typical Cases

In order to test the accuracy of the foregoing statement, an analysis was made of the heat losses from various types of construction for various temperatures and wind velocities, and the results compared with actual meteorological records for the city of New York. The diffusivity was neglected. The types of construction analyzed are as follows:

1. A room having two exposures and with walls of 8-in. brick, wood lath and plaster. Details of the construction are shown in Fig. 1. The windows were assumed to be poorly fitted and non-weatherstripped so that the infiltration losses would be high.
2. A room of the same dimensions and similar to (1) but with no windows. This type was selected to show the effect of variations in temperature and wind velocity when there are no infiltration losses.
3. An all-glass room of the same dimensions. This type was selected to show the effect of changes in temperature and wind velocity on constructions of high rates of transmission, assuming no infiltration. Solar radiation and re-radiation were neglected.

The surface coefficients used in the calculations for various wind velocities were derived from an A. S. H. V. E. research paper entitled, Surface Conductances as Affected by Air Velocity, Temperature and Character of Surfaces, by F. B. Rowley, A. B. Algren and J. L.

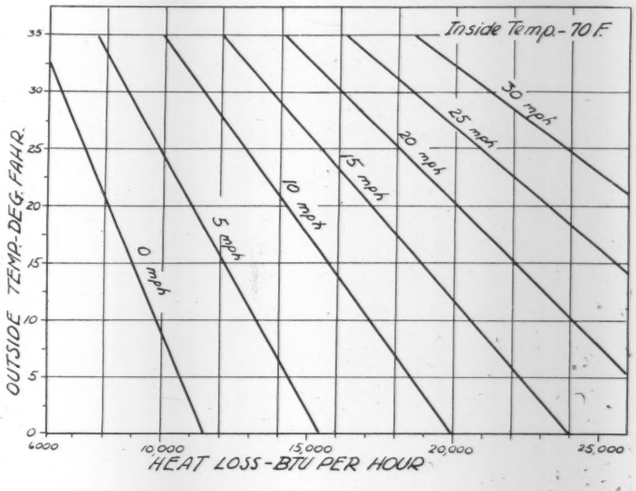


Fig. 2—Heat loss curves for Room No. 1*

*Note: The heat loss curves do not show a constant or consistently varying rate because the infiltration factors upon which the calculations were based do not change the same amount for equal increments of wind velocity. (See factors for poorly-fitted non-weatherstripped double-hung wood windows, Table 2, p. 44, A. S. H. V. E. Guide 1933). Attention is also called to the fact that the transmission losses were corrected for varying wind velocities and that these losses increase as the wind velocity increases. In the case of the transmission losses through glass, this is an important factor.

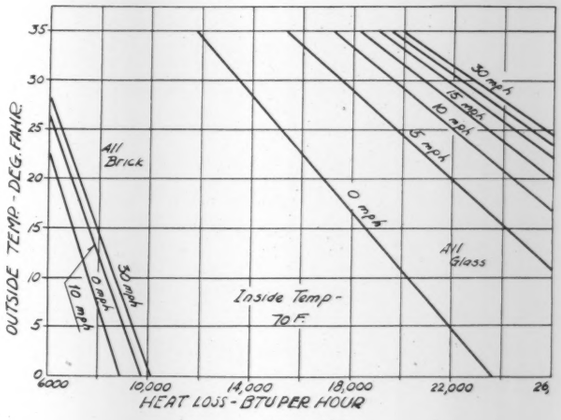


Fig. 3—Heat loss curves for Rooms Nos. 2 and 3

[1]The *diffusivity* is a constant which takes into account the resistance to heat flow and the heat capacity of the structure and is expressed by the following formula:

$$h = \sqrt{\frac{k}{cp}}$$

where
k = conductivity
c = specific heat
p = density

Blackshaw. (A. S. H. V. E. TRANSACTIONS, Vol. 36, 1930). Infiltration data and other coefficients were taken from the A. S. H. V. E. GUIDE, 1933. The method of calculating heat losses was that outlined in Chapter 2 of the GUIDE, 1933, except that no exposure factors were used.

Fig. 2 shows the relation between heat loss, temperature and wind velocity for Room No. 1 shown in Fig. 1. Fig. 3 shows similar curves for Rooms Nos. 2 and 3.

The curve for a wind velocity of 0 mph (Fig. 2) represents *no infiltration*. In other words, for still air conditions, the heat loss of the building obviously is due entirely to the transmission of heat through the brick and glass on account of the difference in temperature on the two sides. As the wind velocity increases the heat loss increases rapidly mainly as the result of infiltration. For this particular case, the heat loss is doubled *for the same outside temperature* if the wind movement changes from 0 mph to about 13.3 mph, and is tripled *for the same outside temperature* if the wind movement changes from 0 mph to 26.7 mph.

On the other hand, it is apparent from Fig. 3 that wind velocity has relatively little effect upon the heat loss from the solid brick wall construction without windows (Room No. 2), since there is no infiltration loss, the only difference being that the exterior surface resistance of the wall decreases as the wind velocity increases. The curves at the left indicate that a change in the wind velocity from 0 to 30 mph increases the heat loss only 13.5 per cent, as compared with 227 per cent in the case of Room No. 1 for the same increase in wind velocity. An intermediate result is obtained in the case of Room No. 3 consisting of all-glass walls, which are assumed to be impervious to air leakage. The increase in heat loss for the same outside temperature is 69.5 per cent, which is due entirely to the decrease in the exterior surface resistance of the glass.

From the foregoing analysis, the following corollary may be deduced:

A. Transmission losses depend upon the temperature head, and to a minor extent (except in the case of highly-conductive walls), upon the wind velocity; infiltration losses depend upon both the temperature head and the wind velocity. There is no general correlation between transmission and infiltration losses nor between temperatures and wind velocities for all types of construction and climatic conditions.

One common method of calculating heat losses is based on the assumption that one mile of wind velocity is equivalent to one degree drop in temperature.[2] If the foregoing corollary is true, the accuracy of this assumption is questionable. Fig. 2 indicates that the heat loss for Room No. 1 will be about 21,200 Btu per hour when the outside temperature is 30 F and the wind velocity is 30 mph. If the theory were correct, these conditions would be equivalent to 0 deg F and 0 mph. However, the heat loss for these conditions will be only 11,500 Btu per hour for Room No. 1 according to Fig. 2, or less than one-half the actual heat loss. In the other two constructions (see Fig. 3), the differences resulting from the use of this rule are smaller, but the case cited, although perhaps extreme, illustrates the danger of applying an empirical rule of this nature to all conditions.

Table 1—Temperatures and wind velocities for New York City for days on which the mean temperature was + 14 F or below*

(January, 1921, to February, 1933, inclusive)

Date	Temperature			Wind		Percent of Possible Sunshine
	Max.	Min.	Mean	Average Velocity	Prevailing Direction	
1-18-21	16	6	11.0	16.8	N W	100
1-19-21	22	4	13.0	6.2	N N W	100
1-25-21	20	4	12.0	20.3	N N W	100
1- 2-22	16	7	11.5	19.8	.....	100
2-17-22	17	−2	7.5	10.8	.....	100
12-30-23	22	7	14.5	9.6	N W, N N W	100
1-27-24	18	5	11.5	13.8	W N W	100
1-23-25	27	2	14.5	21.4	N N W	100
1-24-25	24	2	13.0	10.5	W S W	91
1-28-25	14	−2	6.0	15.4	N N E	93
12-27-25	16	8	12.0	19.8	N W	100
1-29-26	23	5	14.0	15.9	N W	100
2-11-26	21	8	14.5	17.7	N N W	100
12-18-26	20	8	14.0	17.0	N N W	100
1-16-27	22	7	14.5	18.1	N N W	100
1-27-27	25	−1	12.0	6.9	N	94
2-16-30	30	7	18.5	14.2	N N W	100

*Data from New York Meteorological Observatory.

Table 2—Temperatures and wind velocities for New York City for days in the months of December, January and February when the average wind velocity was 22 mph or higher*

(January, 1921, to February, 1933, inclusive)

Date	Temperatures			Wind		Average of Possible Sunshine
	Max.	Min.	Mean	Average Velocity	Prevailing Direction	
1-17-21	38	16	27.0	23.1	N W	100
2-20-21	35	22	28.5	24.5	N E	0
1-11-22	36	26	31.0	26.3	N E	0
1-28-22	32	25	28.5	26.6	N E	0
1-29-22	35	27	31.0	24.2	N N E	38
12-28-22	39	21	30.0	32.0	E N E	0
1- 7-23	24	21	22.5	22.1	N	0
2-15-23	20	12	16.0	22.2	W N W	92
1-26-24	20	7	13.5	24.3	W N W	92
1- 2-25	28	22	25.0	27.0	E N E	0
1-12-25	29	21	25.0	23.0	E N E	0
12- 2-25	44	39	41.5	25.3	E N E	1
12- 3-25	49	39	44.0	30.6	N N E	0
12- 4-25	51	46	48.5	24.3	E N E	0
1-22-26	40	17	28.5	22.3	N N W	66
1-28-26	36	7	21.5	25.0	W N W	81
2- 4-26	30	25	27.5	24.0	N N W	14
12- 8-26	40	30	35.0	31.1	W S W	13
2-19-27	40	25	32.5	23.5	N E	10
2-20-27	25	23	24.0	30.8	E N E	0
12- 4-27	32	23	27.5	28.4	E N E	0
1-25-28	54	26	40.0	24.9	W N W	86
1-29-33	35	30	32.5	24.5	N N W	78
2-27-33	38	24	31.0	22.2	N N W	100

*From New York Meteorological Observatory.

Application of Data to New York City Conditions

Climatological data for New York City from January, 1921, to February, 1933, are given in Tables 1 and 2. Table 1 is for cold days (mean temperature + 14 F or below) and Table 2 is for windy days (average wind velocity 22 mph or higher). Significant so far as calculating heat losses is concerned is the fact that the coldest days were almost invariably clear, there being only three days out of seventeen when there was less than 100 per cent of the maximum possible sunshine, these three days averaging approximately 93 per cent.

[2]The actual drops in temperature per mile of wind velocity for various temperature ranges obtained in certain tests were as follows:

Temperature Range (Deg Fahr)	Temperature Drop per Mile of Wind Velocity (Deg Fahr)
50 F to 40 F	0.75
40 F to 30 F	1.0
30 F to 20 F	1.1
20 F to 10 F	1.2
10 F to 0 F	1.3
0 F to 10 F	1.4
—10 F to —20 F	1.5

NOTE: See paper entitled, Establishment of a Standard Coefficient for Heat Losses Affected by Wind Movement, by H. W. Whitten and R. C. March (A. S. H. V. E., TRANSACTIONS, Vol. 23, 1916.)

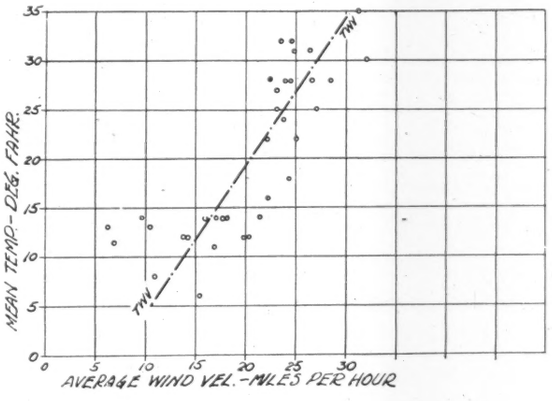


Fig. 4—Mean temperatures and average wind velocities shown in Tables 1 and 2

On the other hand, the windy days were almost invariably cloudy, the average percentage of maximum possible sunshine being 32.1 per cent, there being only two 100 per cent sunshine days out of 24. The probable explanation of the cloudiness on windy days is that a windy day usually signifies the approach or the existence of a storm.

The mean temperatures and average wind velocities indicated in Tables 1 and 2 are plotted in Fig. 4. The line *TWV—TWV* shows the general slope, from which it is apparent that, in the vicinity of New York City, cold days (+ 14 F or below) are not generally windy and windy days (22 mph or higher) during the months of December, January and February are seldom extremely cold. In other words the highest wind velocities and the lowest temperatures do not ordinarily occur on the same days. However, the average wind velocity for the cold days was slightly higher than the average for the months of December, January and February, the former (according to Table 1) being about 15 mph, and the latter (according to Table 2, Chapter 2, A. S. H. V. E. GUIDE, 1933) being 13.3 mph.[3] The average of the mean and minimum temperatures (Table 1) was 12.3 F and 4.4 F, respectively.

The design conditions for New York City would ordinarily be the average wind velocity of 13.3 mph and a temperature 10 or 15 deg above the lowest on record, or, for 15 deg, — 6* + 15 = + 9. These conditions compare with the average wind velocity of 15 mph and the average mean and minimum temperatures of 12.3 F and 4.4 F, respectively, shown in Table 1. Averages of means and extremes, however, are likely to give misleading results and hence an analysis was made of the heat losses for the specific conditions shown in Tables 1 and 2.

Constant heat loss curves for Rooms Nos. 1, 2 and 3 are plotted in Figs. 5 and 6. For example, in Fig. 5, all conditions on the 15,000-Btu curve represent a heat loss of 15,000 Btu per hour. Thus, a temperature of about + 2 F and a wind velocity of 5 mph would result in the same hourly heat loss of 15,000 Btu as a temperature of about 26 F and a wind velocity of 15 mph.

The calculated heat loss of Room No. 1 for the assumed design conditions of + 9 F and 13.3 mph is 19,800 Btu per hour, which condition is indicated immediately to the left of the 20,000-Btu-per-hour line. The mean temperature and wind velocity conditions given in Tables 1 and 2 and designated by dots on Fig. 5 show that in many cases the heat loss would exceed the design heat loss of 19,800 Btu, for this particular case, and for the assumed equilibrium conditions. It is worthy of note that the curves of Fig. 5 show approximately the same general slope as the temperature-wind velocity curve of Fig. 4; also that in many cases the more severe conditions are represented by higher outside temperatures at higher wind velocities. In other words, the greatest

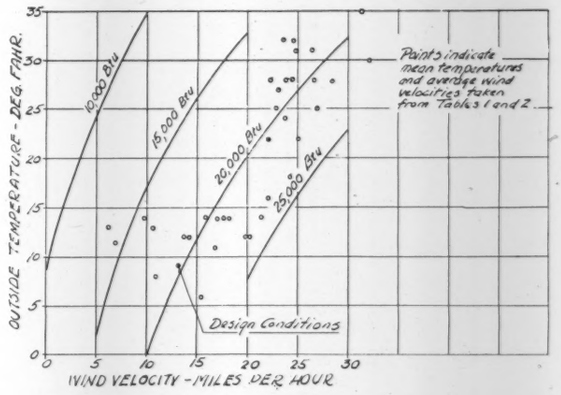

OUTSIDE TEMPERATURE - DEG. FAHR.
WIND VELOCITY - MILES PER HOUR
10,000 Btu
15,000 Btu
20,000 Btu
25,000 Btu
Points indicate mean temperatures and average wind velocities taken from Tables 1 and 2
Design Conditions

Fig. 5—Constant heat loss curves for Room No. 1

heat loss would not take place at the lowest mean temperature of +6 F when the average wind velocity was 15.4 mph, but rather at three other conditions namely 12 F — 20.3 mph, 14 F — 21.4 mph, and 18 F — 24.3 mph.

In the case of the all-brick walls (Room No. 2), the constant heat loss curves for which are shown in Fig. 6, combinations producing the maximum heat losses are quite different. Two temperature-wind velocity conditions indicate heat losses approximately equal to the design heat loss, whereas a third condition, namely + 6 F and 15.4 mph, results in a heat loss somewhat higher than the design heat loss. The average temperature of + 6 F is the lowest given in Table 1. Likewise this temperature produces the highest heat loss for the glass walls, the constant heat loss curves for which are shown by dotted lines, Fig. 6.

In no case are the design conditions the most severe, and the condition which produces the maximum heat loss in the case of the construction shown in Fig. 1 differs from that which produces the maximum heat loss for the other two types of construction.

The following corollaries may therefore be deduced:

B. For any given enclosed space, some concurring combination of temperature and wind velocity will result in a heat loss equal to or greater than other combinations.

The temperature may not necessarily be a minimum nor the wind velocity may not necessarily be in the highest range; furthermore, the concurring combination of conditions may not necessarily be a temperature of 10 or 15 deg above the lowest on record, and the average

[3] This average has diminished somewhat in recent years and according to the latest records the average for the three coldest months is 11.3 mph.
*—6 F is the minimum temperature for New York City, according to Table 2, Chapter 2, A. S. H. V. E. GUIDE 1933. A lower temperature has been recorded in New York City since this table was compiled.

wind velocity during the three coldest months of the year.

C. The temperature wind velocity condition to be selected for calculating the maximum heat loss of a building varies with the type of construction, with particular reference (1) to the amount of crack through which infiltration may take place and the relation of the heat loss resulting thereby to the transmission losses and (2) to the ratio of the surface resistances of those parts of the building structure exposed to the wind, to the total resistance of such exposed parts.

In the cases analyzed, it was found that one or more concurring combinations of temperature and wind velocity resulted in a greater heat loss than the assumed design conditions. It seems probable that in other cases, or in other localities, the reverse might be true, because there are indications that occasionally the calculated heat loss is excessive. This may be due to improper selection of temperatures and wind velocities, failure properly to allow for the diffusivity of the structure, or to other causes such as absorption of solar radiation. However, the analysis thus far appears to indicate that improper selection of temperatures and wind velocities may result in substantial discrepancies between calculated and actual results.

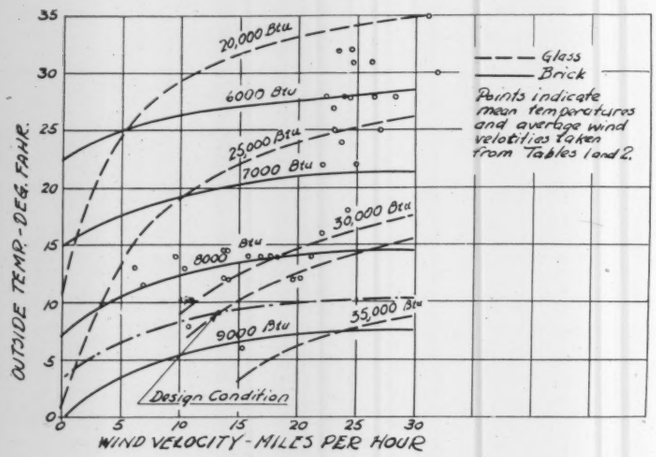


Fig. 6—Constant heat loss curves for Room No. 2 (all brick) and Room No. 3 (all glass)

Hourly Variations

Fig. 7 shows hourly heat loss variations for three days for Room No. 1 as well as the means for these days, and the design heat loss for this room based on + 9 F and 13.3 mph. The data for the three days considered are given in Tables 3, 4 and 5. January 28, 1925, was selected because it was an extremely cold day for New York City. February 20, 1927, was selected because of the high wind velocity on that day, whereas January 1, 1933, was included because it was one of the most severe days during the past few winters.

If the rate of heat loss reacted instantaneously to the weather changes, the curves would be as indicated. However, on account of the diffusivity of the structure, the actual changes would be less marked and the true curves probably would range somewhere between the theoretical instantaneous curves shown and the means for each day.

Attention is called to the fact that the curves for all three of the days selected have the same general characteristics. The maximum heat loss in each case occurred during the early morning hours, which if generally true, might have a bearing on the temperature-wind velocity conditions to be selected for making heat loss calculations. In other words, the conditions used might depend on whether the building is to be heated 24 hours per day or just during the waking hours. However, the heating plant probably should be of sufficient capacity to maintain the desired temperature at all times, in case the need should arise.

An inspection of the curves (Fig. 7) would also raise doubt as to the advisability of considering solar radiation in calculating heat losses, since the maximum demand in all cases occurred during the early morning hours when the sun was not shining. Furthermore, the date on which the maximum average heat loss occurred, namely Feb. 20, 1927, was the exceptionally windy day selected, and was cloudy. It will be observed from Fig. 5 that this date was one of extreme heat loss.

Fig. 7 also illustrates why a heating plant, calculated according to present methods, will apparently function satisfactorily for many years with considerable reserve and will then fail on some day of unusual conditions. This in the writer's opinion is due to the fact that present methods of selecting temperatures and wind velocities do not accurately measure the most severe conditions likely to be encountered. While these particular studies show that the design conditions would have been exceeded in several cases, it is not improbable, as previously stated, that in other localities the design temperature and wind velocity based on present methods might result in a heat loss far in excess of that which would ever be encountered.

Period of Concurrence to Be Considered

If a concurring combination of temperature and wind velocity should be selected for calculating heat losses, the question naturally arises as to the period of concurrence to be considered. In other words, should the mean temperature and average wind velocity selected be for a 24-hour period, for a 1-hour period, or for some other interval of time.

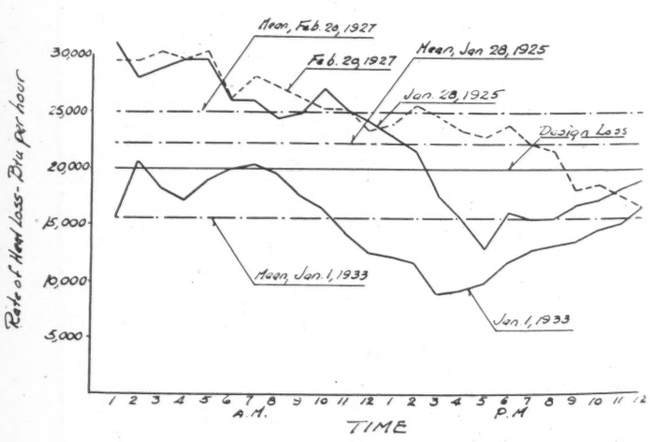


Fig. 7—Hourly heat loss curves for Room No. 1 for Jan. 28, 1925; Feb. 20, 1927, and Jan. 1, 1933

Table 3—Hourly temperatures and average wind velocities for January 28, 1925, in New York City*

Time	Temperature	Average Hourly Wind Velocity	Direction of Wind
1 a. m.	4	26	N N E
2	4	22	N N E
3†	1	21	N N E
4	0	22	N N E
5	−1	21	N N E
6	−2	17	N N E
7 a. m.	−2	17	N N E
8	−1	15	N N E
9	2	17	N N E
10	5	21	N N E
11	6	19	N N E
12	7	18	N E
1 p. m.	10	18	N E
2	11	17	N E
3	13	12	N E
4	13	9	N E
5	11	5	N N E
6	11	9	N N E
7 p. m.	11	8	N N E
8	11	8	N N E
9	11	10	N N E
10	12	11	N E
11	13	13	N E
12	13	14	N E

*Data from New York Meteorological Observatory.
†Slight precip.tation about 3 a. m.
Max. velocity 34 mph N N E.

Table 4—Hourly temperatures and wind velocities for February 20, 1927, in New York City*

Time	Temperature	Average Hourly Wind Velocity	Prevailing Direction
1 a m.	24	39	N E
2	24	39	N E
3	23	39	N E
4	23	38	N E
5	23	39	N E
6	23	33	N E
7 a. m.	24	37	N E
8	25	36	N E
9	25	34	N E
10	25	32	N E
11	25	32	N E
12	25	29	E N E
1 p. m.	25	30	E N E
2	25	33	E N E
3	25	31	E N E
4	25	29	E N E
5	25	28	E N E
6	25	30	E N E
7 p. m.	25	27	E N E
8	25	26	E N E
9	25	20	E N E
10	25	21	E N E
11	25	19	E N E
12	25	17	E N E

*From New York Meteorological Observatory.
NOTE: Percent of maximum possible sunshine —0 percent.
Precipitation, 0.4 in.; rained all day.

Table 5—Hourly temperatures and average wind velocities for January 1, 1933, in New York City*

Time	Temperature	Average Hourly Wind Velocity	Direction of Wind
1 a. m.	25	15	N N W
2	22	22	N N W
3	20	17	N N W
4	18	14	N N W
5	17	16	N N W
6	16	17	N N W
7 a. m.	15	17	N N W
8	13	15	N N W
9	13	12	N N W
10	15	11	N N W
11	18	9	N N W
12	22	8	N N W
1 p. m.	23	8	N N W
2	25	8	N W
3	27	4	N W
4	28	5	W N W
5	27	6	W S W
6	27	9	W S W
7 p. m.	27	11	W S W
8	27	12	W S W
9	26	12	W S W
10	26	14	W S W
11	26	15	W S W
12	25	17	W S W

*Data from New York Meteorological Observatory.

Extreme weather conditions are usually of short duration and are seldom repeated on successive days. Furthermore, it is a well-known fact that the diffusivity of the structure tends to bridge-over temperature valleys of short duration. Hence, it would appear that the period of concurrence to be considered in any case would depend upon the duration and severity of the temperature-wind velocity combination and the diffusivity of the structure. The diffusivity, however, has no direct bearing on the infiltration losses, and relates only to the transmission losses. The study thus far would seem to indicate that a 24-hour rather than an hourly period should be considered.

Exposure Factors

The present practice is to apply an exposure factor to the wall and glass transmission losses and to the infiltration losses on the sides of the building exposed to the prevailing winds. Table 1 shows that on cold days the prevailing direction of the wind was usually northwest or north-northwest. However, in the case of the windy days (Table 2) the prevailing direction of the wind was not as well defined, although the northerly directions predominated. The heat losses on the windy days were frequently as high or higher than on the cold days, and yet from a study of Table 2, there is some doubt as to the direction to which such exposure factors should be applied, unless specific conditions are taken. Apparently, the only direction which would be excluded would be the south.

Exposure factors were originally applied to allow for incomplete data or ignorance concerning the solution of certain phases of the problem. If the temperatures and wind velocities are properly selected and the coefficients and other constants used are accurate, there appears to be no reason for using exposure factors. The allowance for wind direction could be made by using prevailing wind velocities on the sides exposed to the prevailing winds and non-prevailing velocities on the side or sides exposed to non-prevailing winds.

Conclusions

1. Transmission losses depend upon the temperature head, and to a minor extent (except in the case of highly conductive walls), upon the wind velocity; infiltration losses depend upon both the temperature head and the wind velocity. Since the proportions of transmission and infiltration losses to the total vary with the type of construction and temperature and wind conditions, there is no general correlation between temperature and wind velocity for calculating heat losses.

2. For any given room or space, some concurring combination of temperature and wind velocity will result in a heat loss equal to or greater than other combinations.

3. The temperature-wind velocity condition to be selected for calculating the heat losses varies with the type of construction, and for any individual case may be determined from an analysis of local weather conditions.

4. It is probable that temperature-wind velocity combinations for design purposes may be readily ascertained for each locality and for one or more common types of construction, with particular reference to the approximate ratio of the infiltration loss to the total loss.

5. In most cases solar radiation should be neglected since the maximum heat loss usually occurs in the early morning hours when the sun is not shining.

Comparison of Oil and Gas Firing in a Heating Boiler*

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New Haven, Conn.

THE data presented herewith are derived from the cooperative research program of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS and the *American Oil Burner Association* and the Department of Mechanical Engineering of the Yale School of Engineering.

The paper includes: (1) a comparison of a gas burner and two oil burners installed and tested in the same heating boiler and (2) specific examples of the effect of excess air upon burner capacity and boiler efficiency and output.

The heating boiler used in these tests, designated as B 3, was one designed to use either oil or gas. The oil burners were commercial products, of different types, designated as O B 4 and O B 8. The gas burner was of the simple Bunsen, non-mechanical type and designated as G B 1. Any further information regarding the equipment used which might seem pertinent to the data presented will be appropriately mentioned.

The first comparisons were based upon performances obtained under certain standard operating conditions devised for previous studies[3]. These operating conditions may be briefly described as follows: (1) Series *A* tests were obtained by continuous operation at a uniform fuel-burning rate with a furnace draft of 0.02 in. of water and an air-fuel ratio giving about 50 per cent of excess air or 10 per cent CO_2. (2) Series *E* tests were obtained by intermittent operation, the rate of burning when "on" being sufficient to produce a boiler output of 1000 ft steam radiation, the "on" period being 30 min and the "off" periods, 15, 30, 60, 120 and 180 min, respectively. The furnace draft was 0.02 in. of water and the per cent CO_2, 10 per cent as in Series *A* tests.

These two series of tests were chosen to determine what differences in operating efficiencies would be shown. Such data, combined with fuel costs, would indicate the probable economies of the equipment tested when in actual heating service.

Fig. 1 shows a set of Series *A* efficiency curves for oil burners O B 4 and O B 8. It will be noted that the efficiencies are nearly the same although the ranges of output are not. These burners have somewhat similar flame positions in relation to the boiler. They are different in that O B 8 was of the vaporizing blue-flame type and O B 4 of the luminous-flame type. This gives one more instance where the luminous versus the non-luminous flame burners showed essentially similar results for similar flame positions and air-fuel ratio. Reference to a previous study[3] shows that overall efficiencies under similar test conditions will not necessarily be the same for all types of burner. The most striking difference between types is in flame position and shape. While additional reasons may exist, it seems very probable that differences in heat losses through the floor and the foundation side walls will account for some of the variations in efficiency.

Similarity of flame position is emphasized because the gas burner and the oil burners have similar flame locations and to that extent the comparisons to be made seem to be based upon the most comparable conditions. References to Fig. 4 will show, however, that furnace volume B is not equal in all cases and this presupposes higher losses where the ratio (furnace B to furnace A) is the higher because of larger bounding side-wall areas through which heat may be lost.

Fig. 2 shows the Series *A* type of efficiency curve for O B 4, O B 8 and G B 1. The gas burner was set for the same air-fuel ratio as the oil burners (i. e., 50 per cent excess air). It was necessary to reduce to 0.012 the furnace draft value of 0.02 in. of water when using

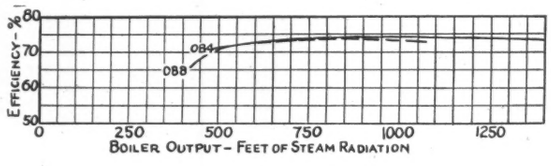


Fig. 1—Comparison of efficiencies. Series *A*—Continuous tests

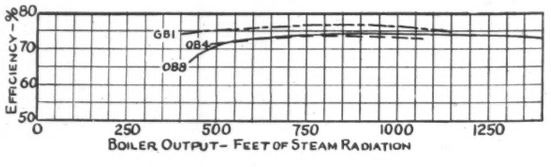


Fig. 2—Comparison of efficiencies. Series *A*—Continuous tests

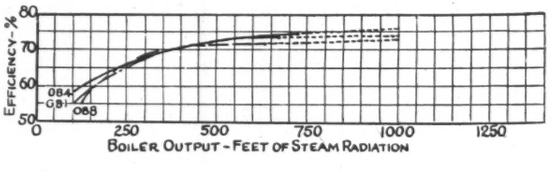


Fig. 3—Comparison of efficiencies—Series *E*—Intermittent tests

*Presented at the *American Oil Burner Assn.*, Chicago, Ill., June, 1933.

[1]Assistant Professor of Mechanical Engineering, Yale School of Engineering, Yale University.

[2]Assistant in Research, Yale Graduate School, Yale University.

[3]Study of Performance Characteristics of Oil Burners and Low-Pressure Heating Boilers, by L. E. Seeley and E. J. Tavanlar, A. S. H. V. E. JOURNAL SECTION *Heating, Piping and Air Conditioning*, May, 1931.

G B 1 at the lower outputs. The effect of this, if any, would be to improve the overall efficiency.

A study of Fig. 2 shows that the gas burner produced overall efficiencies somewhat higher than the oil burners. This is more noticeable at lower outputs. A comparison of the major items of a heat balance reveals certain interesting material. The following is based upon practically equal total heat liberation rates:

Burner	O B 4	G B 1
Per cent Excess Air, %	50.0	50.0
Overall Efficiency, %	74.50	76.10
Hydrogen Loss, %	6.88	10.75
Dry Flue Gas Loss, %	6.19	5.09
CO Loss*	0.00	0.00
Radiation and Unaccounted For Losses	12.43	8.06
	100.00	100.00

*Based on Orsat analysis which does not meet *American Gas Association* standards. If any CO was present it was too small in amount to affect the results very much.

The tabulation shows a difference in radiation losses which bear out previous comments relative to flame position. It shows that the gas used, ordinary illuminating gas of 533 Btu per cubic ft, will give a greater hydrogen loss than oil. A question can be raised as to what are really comparable test conditions. Fifty per cent excess air with both fuels will not give the same weight of excess air per unit of heat generated. If the dry flue gas loss is broken down and the loss due to excess air alone is separately determined, it shows a difference of 1.30 per cent. Since the balances were derived from tests run at about 1000 ft of steam radiation output, it is evident that a procedure based upon settings calculated to give equal quantities of excess air per unit of heat generated would give practically identical efficiency results. If this explanation entirely sufficed, the same differences should be indicated at all outputs but this is not so. This will be discussed later.

Fig. 3 shows a set of Series *E* efficiency curves. The operating setting in all cases was at a boiler output of 1000 ft steam radiation, 50 per cent excess air and 0.02 in. furnace draft.[4] The general conclusion from these curves is that a gas burner shows characteristics similar to an oil burner when the operating conditions are substantially the same.

Also, when operating conditions are changed by increasing the percentage of excess air the gas burner shows the same trends previously pointed out for oil burners (i.e., reduced efficiency and boiler output and increased flue gas temperatures).

Fig. 4 and and 5 show volume ratios and actual heat liberation rates per cubic ft of furnace volume (furnace volume B) above the hearth of the burner or its equivalent. It is common to find higher heat liberation rates for gas than for oil. No particular significance is attached to these values inasmuch as high heat liberation rates are possible with oil and will probably be utilized in future oil-burning equipment.

Besides the comparisons listed, further work was done with O B 4 and G B 1 under conditions deviating from the standards of Series *A* and *E* tests. Series *E 1* tests were similar to Series *E* except that the boiler output when the burner was "on" was about 650 ft steam radiation instead of the standard 1000 ft. Series *E E 1* represents a type of test similar to the others with the exception that the excess air during the "on" period was 280 per cent instead of the standard 50 per cent. The change from Series *E* was caused by the increase in excess air for Series *E E 1*. The fuel burning rate was reduced because of the limit on the supply of air to obtain the desired percentage of excess air for Series *E E 1*.

[4]A Study of Intermittent Operation of Oil Burners, by L. E. Seeley and H. H. Powers, A. S. H. V. E. Journal Section *Heating, Piping and Air Conditioning*, February, 1932.

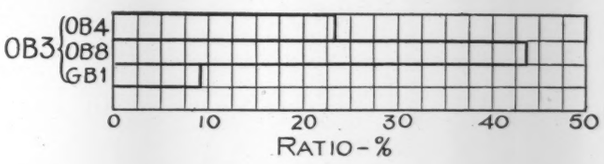


Fig. 4—Ratio of furnace volume *A* to furnace volume *B*. Furnace volume *A*—before installation of burner. Furnace volume *B*—after installation of burner

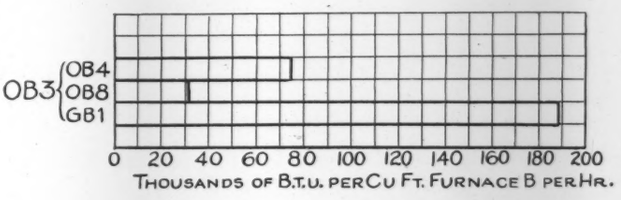


Fig. 5—Heat liberation rates at 1,000 ft steam radiation boiler output

Series *H H* are tests run under continuous operation (like Series *A*), where, with a constant fuel-burning rate, the excess air was changed by increments from 50 per cent to 280 per cent.

Series *H* represents continuous-type tests run with a constant air supply but with varying quantities of fuel such as to give percentages of excess air ranging from 50 to 280 per cent.

Series *H H* represents varying quantities of air with constant fuel and Series *H*, varying quantities of fuel with constant air. The lowest points on Series *H H* and Series *H* curves coincide. This point was found when the full supply of air available was being used.

The object of Series *H H* is to show the decrease in overall efficiency and boiler output which results from an increase in excess air. Series *H* is particularly intended to show the increase in capacity obtained by decreasing the excess air.

Fig. 6 shows the curves for both of the above series of tests. Series *H H* shows: (1) increase in excess air (50 per cent to 280 per cent) (2) decrease in CO_2 (10 per cent to 4 per cent) (3) decrease in efficiency (4) decrease in output (5) increase in flue gas temperature and (6) increase in exit draft (i.e., increase in draft loss through the boiler).

Series *H* curve shows how the capacity or output is increased by a decrease in excess air or increase in CO_2. The air supply remained constant for these tests but the proportion of fuel to air was altered. The exit draft remained practically constant, though the exact draft loss through the boiler may not be precisely measured in this type of boiler. The important fact to note is that the combustion rate was increased approximately 104 per cent and the boiler output about 139 per cent.

The impossibility and impracticability of setting com-

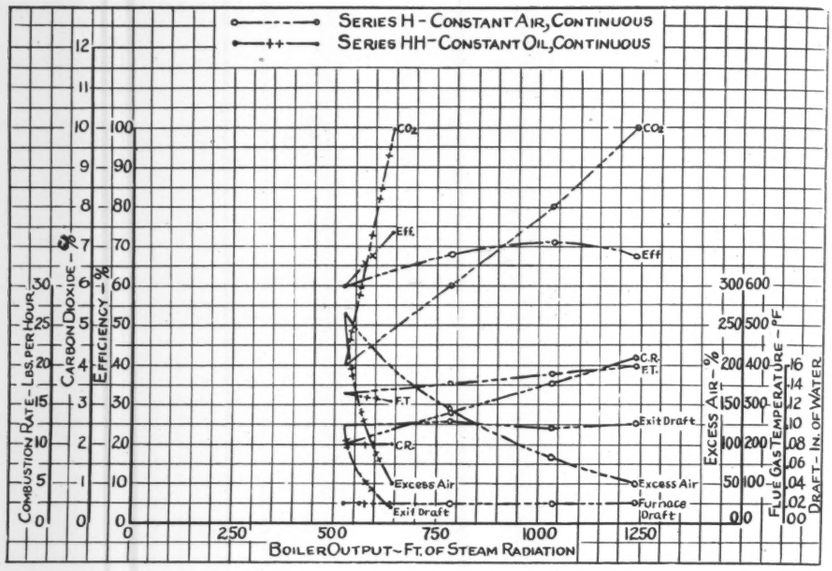


Fig. 6—Performance Chart—*OB4B3 II*

mercial or catalog fuel-burning rates, especially maximum rates, without a qualification as to excess air or percent CO_2 should be obvious from this chart. The effect of excess air on boiler capacity should indicate a possible source of difficulty where burners, after installation, are said to be too small.

Fig. 7 shows in more detail the effect of excess air variations at a constant fuel-burning rate for O B 4.

Fig. 8 shows Series *H H, E1* and *E E 1* curves for O B 4 and G B 1. The object is to compare the performance of the burners when the excess air is increased and to make another comparison of intermittent tests (Series *E* type). The intermittent tests show the usual drooping characteristic. The curve shapes are not the same but previous work[4] showed that the decrease varied with burner types and bore an undoubted relation to the loss occurring during the "off" period.

The disturbing result is that the change in efficiency (Series *H H*) due to a change in excess air was not the same for O B 4 and G B 1. Previous data would point to the conclusion that burners of similar flame positions and producing similar quality of combustion would produce comparable economic results. To conclude from Fig. 8 that a gas burner is less affected by changes in excess air requires more data than are contained in this paper. A comparison of heat balances of O B 4 and G B 1 revealed a possible explanation but left insufficient assurance that the same would be true for all oil burners.

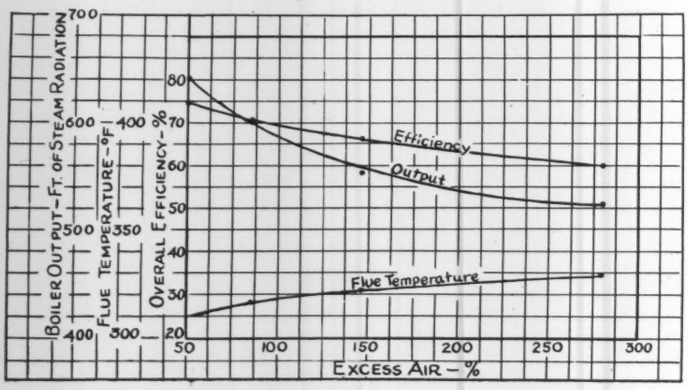
Heat Balance

Burner	O B 4		G B 1	
Per cent Excess Air, %	50	280	50	280
Overall Efficiency, %	74.50	60.20	76.10	69.40
Hydrogen Loss, %	6.88	6.91	10.75	10.80
Dry Flue Gas Loss, %	6.19	15.92	5.09	13.16
CO Loss, %	0.00	0.00	0.00	0.00
Radiation and Unaccounted % for Losses	12.43	16.97	8.06	6.64
	100.00	100.00	100.00	100.00

The table is based upon similar total heat liberation rates and the same furnace drafts.

It should be noted that the last item, radiation and unaccounted-for losses, provides a clue. This loss for O B 4 increases over 4.5 per cent, whereas one would expect this value to stay reasonably constant, allowing for experimental error of ± 2 per cent. This condition

Fig. 7—Effect of excess air on the efficiency output and flue temperature of *OB4B3* at 10 lb per hour oil rate



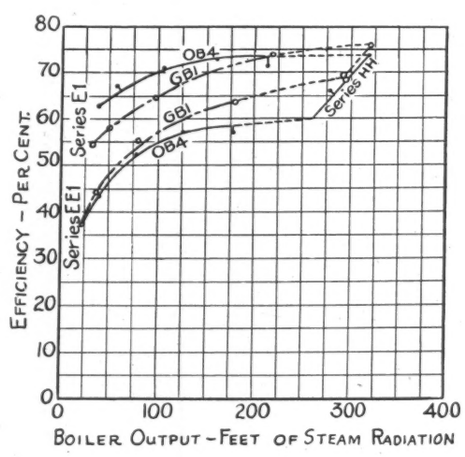


Fig. 8—Comparison of efficiencies *OB4-GB1-B3*
Series *E1*—intermittent 50% excess air
Series *EE1*—intermittent 280% excess air
Series *HH*—continuous, constant total heat liberation rate

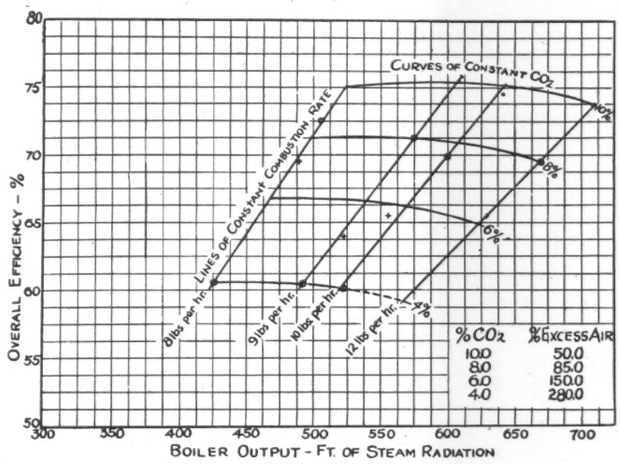

CURVES OF CONSTANT CO_2
LINES OF CONSTANT COMBUSTION RATE
8 lbs per hr.
9 lbs per hr.
10 lbs per hr.
12 lbs per hr.
% CO_2 | % Excess Air
10.0 | 50.0
8.0 | 85.0
6.0 | 150.0
4.0 | 280.0
OVERALL EFFICIENCY - %
BOILER OUTPUT - FT. OF STEAM RADIATION

Fig. 9—Efficiency curves of *OB4B3* at various combustion rates and percentages of CO_2

is found in the case of G B 1. This difference coupled with the discrepancy of that part of the dry flue-gas loss due to excess air, previously discussed, would practically account for the differences in efficiencies at 280 per cent excess air.

In order to check the results, further tests were run on O B 4 at various flue rates and percentages of excess air. Fig. 9 shows the results of these tests. The furnace draft was the same in all tests, 0.02 in. of water. Note that the lines of constant combustion rate will all intersect at the origin of the chart, if extended.

The heat balances of these tests are given in the accompanying table.

It will be noted that the "radiation and unaccounted for loss" increased with the increase in excess air. The 12-lb rate at 280 per cent excess air could not be run due to insufficient available air.

The only explanation which can be given at this time is that some of the hydro-carbons were unconsumed and that the proportion increased with the increase in excess air. These constituents were not measured so the above can be considered only as an opinion. That other oil burners will show the same traits is neither proved nor disproved. If the explanation is correct, however, it would serve to explain the difference shown in the *H H* curves of Fig. 8 and would seem to emphasize still more the importance of adjusting oil burners for air-fuel ratios which represent good practice (i.e., 50 per cent excess air).

Summary of Heat Balances

Fuel Burning Rate, Lb./Hr.	8				9				10				12			
Percentage of Excess Air, %	50	85	150	280	50	85	150	280	50	85	150	280	50	85	150	280
Overall Efficiency, %	75.0	72.5	69.7	60.5	75.8	71.2	69.11	60.5	74.51	69.75	66.20	60.19	73.8	69.5	65.5	.....
Hydrogen Loss, %	6.9*	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	No
CO Loss, %	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Test
Radiation and Unaccounted For Loss, %	12.42	13.74	13.91	17.97	11.78	14.82	14.29	17.97	12.42	15.56	16.33	16.98	12.26	14.25	15.42	.....

*Average value employed because the deviation is slight in all cases.

The Society's Research Program

Prof. G. L. Larson, chairman of the Committee on Research, has listed the research projects on which work is now being done and indicates that reports will be presented in the form of papers at future meetings of the Society.

A. S. H. V. E. Laboratory at Pittsburgh

1. Study of the effects of venetian blinds on diverting the radiant energy from the sun and reduction of cooling loads.
2. Study of heat transfer coefficients in actual buildings.

Harvard University

1. Study of minimum amount of outside air required for ventilation.
2. Effect of ionized air on human health and comfort.

University of Illinois

1. Residence cooling study.
2. Use of eupatheoscope as a means of measuring room comfort and relative economy of various types of radiation.

University of Minnesota

1. Heat transmission through walls and building materials.
2. Efficiency of filters used in connection with warm air systems.

University of Wisconsin

Relative economy of heating a shop type of building with different types of heating systems: (1) direct radiation; (2) suspended unit heaters; (3) floor type unit heaters.

Texas Agricultural and Mechanical College

A study of the effect of insulation in actual buildings.

University of Kansas

Continuation of the study of garage ventilation.

Michigan School of Mines and Technology

Corrosion in return mains.

Case School of Applied Science

A study of heat transmission in finned tubing under forced draft air movement.

Yale University

Concluding series of studies of the operation of oil burners and heating boilers.

Professor Larson points out that it is encouraging to note that many of the cooperating universities are continuing research on problems of interest to Society members without the accustomed financial support of the Society and feels that this is a tribute to the Society's prestige.

The necessity for support of the Society's Laboratory by members is essential at this time in Chairman Larson's opinion and every member is urged to contribute his share by paying dues promptly.

Special commendation is due the Research Finance Committee, headed by J. H. Walker of Detroit, and to the small group of associations, manufacturers and individuals who have continued their financial support of the Laboratory during the current year.

NOMINATIONS FOR 1934

The Nominating Committee appointed to select candidates for Officers of the Society for the coming year, 1934, submits the following list of nominees:

For President:

C. V. HAYNES, Philadelphia, Pa.

For First Vice-President:

JOHN HOWATT, Chicago, Ill.

For Second Vice-President:

G. L. LARSON, Madison, Wis.

For Treasurer:

D. S. BOYDEN, Boston, Mass.

For Members of the Council:

Three-Year Term

E. H. GURNEY, Toronto, Ont.
W. A. RUSSELL, Kansas City, Mo.
O. W. OTT, Los Angeles, Calif.
M. C. BEMAN, Buffalo, N. Y.

One-Year Term

ALBERT BUENGER, St. Paul, Minn.

Respectfully submitted,

NOMINATING COMMITTEE.

W. R. EICHBERG, *Chairman;*
C. A. PICKETT, *Secretary.*

In accordance with the provisions of the Amended Constitution, as given, ballots containing the names of the above candidates will soon be sent to the membership for voting upon prior to the Annual Meeting in January.

Art. B-VIII—Section 10. The Nominating Committee shall consist of one (1) member eligible to vote designated by each Chapter, or his alternate also appointed by the Chapter. The Secretary of each Chapter shall certify to the Secretary of the Society on or before January first the names of the member and alternate selected.

The Committee shall meet at the Annual Meeting of the Society at the call of the Secretary of the Society and shall effect its own organization and elect its own Chairman. At the Semi-Annual Meeting of the Society, if possible, the Nominating Committee shall select the nominees for the ensuing year for the offices of President, First Vice-President, Second Vice-President, Treasurer, and four (4) members of the Council. In any event the names of the nominees shall be certified to the Secretary of the Society before September twentieth, with the written consent of each nominee to fill the office for which he has been selected and their names with the offices to which they have been nominated shall be published in the October issue of the JOURNAL.

Art. B-IX—Section 2. The Secretary shall prepare ballots with the names of all candidates and forward them to the members, eligible to vote, at least thirty (30) days before the date of the Annual Meeting.

Nominations for Members of Committee on Research

Although committees of the Society are usually appointed, in view of the great importance of the Committee on Research and the financial responsibility it would be called upon to assume, it has been made more representative of the entire membership of the Society by a process of *election*. The election is governed by the By-Laws for the election of officers, with the single exception that Members of the Committee on Research are nominated by the Council instead of by a Nominating Committee.

In accordance with the Regulations for the Government of the Research Laboratory, adopted at the January, 1919, Meeting, and amended January, 1933, the Council announces the nomination of the following members of the Committee for election to succeed those members whose present terms expire January, 1934:

Three-Year Term

C. A. BOOTH, Buffalo, N. Y.
E. K. CAMPBELL, Kansas City, Mo.
JOHN HOWATT, Chicago, Ill.
A. J. NESBITT, Philadelphia, Pa.
J. H. WALKER, Detroit, Mich.

The regulations governing the nomination and election of members of the Committee on Research are as follows:

ARTICLE II—ORGANIZATION

Section 1. *Committee on Research*—There shall be a standing committee known as the Committee on Research, consisting of fifteen (15) members each serving for three (3) years and five (5) retiring each year. The outgoing Chairman if serving in that capacity during the last year of his three (3) year term on the Committee shall without election become an additional member of the Committee on Research for one (1) year.

(a) The Council shall nominate previous to July first of each year five (5) members to fill the vacancies of those retiring at the next Annual Meeting.

(*b*) The nominations made by the Council shall be published in the October issue of the Society's Journal.

(*c*) Any ten (10) members of the Society eligible to vote may present to the Secretary over their signatures, the name of one (1) or more additional nominees for the Committee on Research, provided such name or names are presented at least sixty (60) days prior to the next Annual Meeting, and such additional nominations shall be placed on the ballot opposite the nominations made by the Council.

(*d*) The election shall otherwise conform to the regulations provided for the election of officers of the Society in the Constitution, By-Laws and Rules.

(*e*) Vacancies may be filled by the Council, such persons chosen by the Council to serve until a successor is elected at the next Annual Meeting.

Courtesy Consolidated Gas Co. of New York

Downtown New York at Night

40th Annual Meeting Plans

THE anniversary of four decades of service by the A. S. H. V. E. will be celebrated in New York City during the week of February 5, 1934.

After an absence of five years the Society returns to New York for an Annual Meeting and headquarters will be at the Hotel Biltmore, conveniently located in the Grand Central district and adjacent to Grand Central Palace where the Third International Heating and Ventilating Exposition will be held, February 5-9.

A series of technical sessions are scheduled and the papers offered cover a wide field of interest including studies of sun effect, warm air heating controls, air conditioning of homes, and health studies in relation to air conditioning.

The New York Chapter of the Society will be host to the visiting members and the entertainment activities will be directed by Arthur Ritter, General Chairman of Arrangements.

Hours will be provided for an opportunity to visit the Third International Heating and Ventilating Exposition at Grand Central Palace, where exhibits will portray developments in the fields of combustion, warm air heating, steam and hot water heating, electric heating, district heating, refrigeration as applied to air conditioning, insulation and the specialties which include heaters, piping, pumps, traps, valves, fittings, and recording, measuring and control devices.

New York affords much for education and amusement. Some of the well-known places to visit are: New York University with its Hall of Fame, Columbia University Library, Roerich Museum where modern paintings and sculpture are exhibited, New York Museum of Science and Industry, Museum of the City of New York, Metropolitan Museum of Art, American Museum of Natural History, Grand Central Art Galleries, Theodore Roosevelt Memorial, Grant's Tomb, and the Aquarium.

Then there are the famed white lights of Broadway with a choice of theatrical attractions, hotels and night clubs, where dinner and supper dancing are provided.

A moderate scale of hotel rates will be in effect and reduced round trip railroad fares will be available from all points.

Council To Meet in Chicago

A meeting of the Council has been called by Pres. W. T. Jones for October 25, in Chicago, Ill., at 10 a. m. central standard time. Plans for the Society's 40th Annual Meeting will be discussed, membership and dues problems will be considered and several reports of special committees will be received.

Code for Engineers in the Construction Industry

On Sept. 18 a Code of Fair Competition for the Professional Engineer Division of the Construction Industry prepared by representatives of several national engineering societies was submitted to the National Industrial Recovery Administration in revised form for public hearing. Copies are being printed and may be secured by addressing the NRA, Commerce Bldg., Washington, D. C.

The code defines the functions of the professional engineer, gives regulationship between engineers and clients, lists unfair practices, and provides for a committee of administration.

Announcement has been made by Pres. W. T. Jones of the appointment of John R. Eadie, consulting engineer, New York, as the A. S. H. V. E. representative.

President Jones Addresses Western Members

An extensive itinerary has been planned by Pres. W. T. Jones for the month of October and he will discuss The Status Quo of the Society with seven chapter groups.

Commencing on October 3, he will visit the Cincinnati Chapter and on the evening of the 4th he will address St. Louis Chapter members. His schedule brings him to Kansas City for the evening of October 5, after which he will visit the Pacific Coast Chapters.

In Los Angeles, the Southern California Chapter will meet October 10. A conference with San Francisco members will be held October 16 and on Thursday evening, October 19, the Pacific Northwest Chapter will entertain Mr. Jones in Seattle.

On Monday evening, October 23, the Minnesota Chapter will open its fall season with President Jones as the featured speaker and the following evening, October 24, Wisconsin Chapter at Milwaukee will entertain him.

On November 20 the New York Chapter will have President Jones as its guest and in December the Massachusetts Chapter has planned a reception in his honor.

Local Chapter Reports

Cincinnati

The Cincinnati Chapter will begin activities on October 3, when W. T. Jones, Boston, Mass., president of the A. S. H. V. E., will address members and guests on The Status Quo of the Society and, in November, the speaker will be W. H. Driscoll, New York, N. Y., chairman of the Society's Committee on Ventilation Standards.

The total number of members on the Chapter Roll September 1, 1933 was 27 and the following officers and committees are in charge of activities:

President—K. A. Wright.
Vice-President—H. N. Kitchell.
Secretary-Treasurer—G. B. Houliston.
Board of Governors—K. A. Wright, H. N. Kitchell, G. B. Houliston, E. B. Royer, C. J. Kiefer.

COMMITTEES

Membership—C. J. Kiefer, *chairman*.
Meetings—E. B. Royer, *chairman*.
Publicity—I. B. Helburn, *chairman*.
Finance—G. B. Houliston, *chairman*.
Legislative—K. A. Wright, *chairman*.

The report, prepared by Pres. K. A. Wright, outlines the meetings held during the 1932-33 season:

December—Dean F. Paul Anderson, University of Kentucky, Lexington, Ky., speaker. Subject: Future of Air Conditioning. Attendance—150.

February—R. M. Conner, American Gas Association, Cleveland, Ohio, speaker. Subject: Gas for Heating. Attendance—60.

March—M. A. Smith, U. S. Gypsum Co., speaker. Subject: Architectural Acoustics and Noise Problems of Heating and Ventilating Systems. Attendance—50.

April—A. J. Nesbitt, J. J. Nesbitt Co., Philadelphia, Pa., speaker. Subject: A Logical Basis for Determining the Volume of Air to Be Circulated in Schoolroom Ventilation. Attendance—50.

May—E. B. Newell, Frigidaire Corp., Dayton, O., speaker. Subject: Unit Air Conditioners. Attendance—125.

Cleveland

The following officers will assume their new duties when the Cleveland Chapter holds its first meeting of the 1933 fall season:

President—F. A. Kitchen.
Vice-President—M. F. Rather.
Secretary—R. H. Wehrle.
Treasurer—H. M. Nobis.
Board of Governors—R. G. Davis, Philip Cohen, J. W. Farley.

A synopsis of the meetings held from October, 1932, to May, 1933, is given by Secy. R. H. Wehrle in his annual report:

October, 1932—Theodore Maynz, Consulting Engineer, gave a detailed talk on Combustion: Its Theory and Practice, with 32 members and guests present.

November, 1932—Frank C. Lyons addressed the Chapter on the subject of Air Conditioning and Cooling. His talk was followed by a discussion on Air Movement in Rooms led by R. G. Olson.

December, 1932—A Logical Basis for Determining the Air Volume to Be Circulated in Classroom Ventilation, presented by A. J. Nesbitt, gave the Chapter its most lively discussion of the year. Mr. Nesbitt's talk covered a series of tests made in the schools of Philadelphia. Twenty-five members and guests attended.

January, 1933—H. B. Meller, Chief of the Bureau of Smoke Regulation for Pittsburgh, talked on the Control of Air Pollution, emphasizing the cost of smoke and soot upon the community. At this meeting there were 55 members and guests.

March, 1933—An illustrated talk by Harry Matzen on the complete air conditioning of the Reynolds Arcade Building, Rochester, N. Y., made this one of the most interesting meetings of the year, at which 34 guests and members of the Chapter were in attendance.

April, 1933—The President of the A. S. H. V. E., W. T. Jones, Boston, Mass., was the speaker of the evening, with 20 members and guests of the Chapter present.

May, 1933—Welded Steel Frame House Construction and Application of Heating and Air Conditioning was the subject of a talk given by Charles A. Burton. The attendance at this meeting was 37.

Illinois

The meetings of the Illinois Chapter held during the past year are summarized by Secy. J. J. Hayes as follows:

Meeting		Attendance	Speaker	Subject
October,	1932	97	C. M. Terry	Consumers Service.
			John Jenkins	Coke Utilization.
			B. R. Gebhardt	Bituminous Coal for Domestic Stokers.
(Committee of Ten of the Coal Industries were guests.)				
November,	1932	53	W. I. Hooper	Architect's Viewpoint on Ventilation.
			W. L. Fleisher	Cooling by the Steam Ejector System.
December,	1932	48	W. H. Driscoll	A Romance of Building.
January,	1933	189	Prof. H. J. Macintire	Refrigeration and Its Application in Air Conditioning.
(A joint meeting with the Chicago Section of the *A. S. R. E.*)				
February,	1933	48	Prof. L. R. Flook	University of Chicago Carillon.
			Prof. G. L. Larson	Research Accomplishments in 1932.
March,	1933	102	C. A. Donnel	Forecasting the Weather.
			W. D. Mitchell	The Application of Gas to Water Heating.
April,	1933	48	W. T. Jones	Status Quo of Our Society.
			J. W. Gorby	Highlights in the Development of the Century of Progress.
May,	1933	54	Bennett Chapple	Tomorrow's Home.
			A. R. Herske	Profits in the Contracting Business.

A joint meeting of the Illinois, Kansas City, St. Louis and Wisconsin Chapters was held on October 15, 1932, at the University of Illinois. Thirty-five members from 10 cities attended.

On April 29, 1933, another joint meeting was held at La-Crosse, Wis., by the Wisconsin, Minnesota and Illinois Chapters.

The Annual Meeting of the Society at Cincinnati was attended by 14 Illinois Chapter members; the Semi-Annual Meeting at Detroit by 20. The average attendance at regular Chapter meetings has been 79.

The officers and committees serving the Chapter since their election at the Annual Meeting October 10, are:

President—J. H. O'Brien.
Vice-President—C. W. DeLand.
Secretary—J. J. Hayes.
Treasurer—J. H. Milliken.
Board of Governors—J. J. Aeberly, G. H. Blanding, R. E. Hattis.

Legislative
J. H. O'Brien, *Chairman*
H. M. Hart
E. V. Hill
E. P. Heckel

Better Relations
J. J. Aeberly, *Chairman*
S. R. Lewis
L. L. Narowetz

Membership
R. E. Hattis, *Chairman*
George Blanding
J. J. Hayes
M. S. Good
H. R. Linn
A. G. Sutcliffe
L. L. Narowetz
L. J. Pitcher
R. M. Getschow
G. W. Schuengel

Finance
J. H. Milliken, *Chairman*
J. J. Haines
C. W. Johnson
J. F. Hale
John Howatt

Publicity
L. B. Spafford, *Chairman*
R. M. Moffitt
R. B. Hayward
E. Mathis
S. I. Rottmayer
R. E. Hattis
P. J. Marschall
Edward Moore
H. G. Kreissl

Meetings and Publications
C. W. DeLand, *Chairman*
John Howatt

The Illinois Chapter membership roll now lists 129 members. A liberal stand has been taken during the past year regarding the payment of dues, as a number of members have been unemployed for some time. When a member in arrears still shows interest in Chapter affairs and has expressed the desire of being carried for a while, the Board of Governors has deemed it wise to retain the delinquent member's name on the books. Therefor, 25 members are in arrears for one year, 6 for two years, and 1 for three years. All of these delinquent members have promised to make every effort to return to good standing as soon as their financial affairs permit.

Kansas City

The Annual Report of the Kansas City Chapter, prepared by Secy. C. A. Weiss, advises that the new year was begun with a meeting on September 11 and the October meeting set for the 5th, when W. T. Jones, Boston, Mass., president of the Society, will be the guest of honor.

All meetings of the Chapter are preceded by dinner and are held monthly at the Newbern Hotel, 525 E. Armour Blvd. No regular meeting date is planned, due to the fact that frequently changes are necessary to accommodate the speakers. The membership status of the Chapter on September 12 is given as 43.

The names of officers and committee members for 1933-34 are listed herewith:

President—David Caleb.
Vice-President—D. D. Zink.
Secretary—C. A. Weiss.
Treasurer—L. A. Stephenson.
Board of Governors—B. F. Cook, W. A. Russell, Emil Haas.

COMMITTEES

Program—D. D. Zink, *chairman;* W. A. Russell, Carl Clegg, F. V. Becklean.
Legislative—J. M. Arthur, *chairman;* B. F. Cook, F. A. Sheppard.
Membership—E. K. Campbell, *chairman;* Emil Haas, L. R. Chase.
Publicity—Carl Clegg, *chairman;* David Caleb, C. A. Flarsheim.
Entertainment—B. F. Natkin, *chairman;* Emil Haas, L. A. Stephenson.
Civic—J. H. Kitchen, *chairman;* F. F. Dodds, H. C. Henrici.
Code—N. W. Downes, *chairman;* W. E. Gillham, Henry Nottberg.
Chapter Welfare—L. W. Millis, *chairman;* J. G. Lewis, E. K. Campbell, Jr.

A review of the meetings held during the past Chapter season is included in the annual report.

October 24, 1932—Some time was devoted to a discussion of programs for the ensuing year. An address was given by Prof. F. B. Rowley on Aims and Purposes of the Society. The educational feature of the evening was a paper by D. D. Zink, entitled Air Conditioning for Human Comfort and Industry.

November 14, 1932—Plans were made for a joint meeting with the *A. S. M. E.* The feature of the evening was a paper by A. J. Nesbitt on School House Ventilation.

December 12, 1932—Plans were made to include the *A. I. E. E.* in the joint meeting of the A. S. H. V. E. and the *A. S. M. E.* in February, 1933. The regular educational feature was provided by E. K. Campbell in a paper on Air Movement. The guest speaker was M. A. Smith, Chicago, who gave a most interesting and educational address on various phases of acoustical treatment of rooms and machinery to eliminate objectionable noise.

January 9, 1933—Twenty-five members and guests were present when Walter Matscheck, director of the Kansas City Civic Research Institute, addressed the chapter on the subject of Reduction in Governmental Costs. The regular educational feature was provided by N. W. Downes in a discusion of the new Ventilation Standards, in which practically everyone present took part.

February 17, 1933—A joint meeting of the A. S. H. V. E., the *A. S. M. E.* and the *A. I. E. E.* was held in Thomas A. Edison Hall, an air conditioned auditorium in the Kansas City Power and Light Office Building, with over 500 in attendance. Engineering and technical societies, architects and members of the Real Estate Board were invited. Arrangements were made by the Kansas City Chapter of the A. S. H. V. E. for the principal speaker, S. R. Lewis, consulting engineer, Chicago, who spoke on Air Conditioning for Human Comfort.

March 13, 1933—Sidney Pines gave the educational feature in a paper on Recent Developments in Steam Heating Equipment at this meeting when 45 attended. Plans were made to celebrate the golden wedding anniversary of one of the Chapter's most active members, L. W. Millis. A lecture and demonstration by R. J. Thompson presented the cause both for and against F12 (freon).

April 6, 1933—An address was given by T. A. Novotney on an Engineer's Approach to the Design of Convectors. Ed Casey, Chicago, was also present. Carl Clegg and W. A. Wirene presented some facts relative to fans, motors and controls. W. J. Squire, an electrical contractor, spoke in behalf of the Kansas City Renovizing Campaign.

May 10, 1933—At this meeting officers were elected for the year 1933-34. W. A. Russell told of the coming meeting in Detroit in June and Engineers' Day at the World's Fair. Two local members read very able papers: L. W. Millis discussed Combustion Stokers, Oil and Gas Burners and David Caleb presented the subject of Heating and Ventilating in Perspective.

June 12, 1933—The annual social meeting of the Chapter was held at Oakwood Country Club. About 75 were present and enjoyed a wonderful repast on the open terrace, with music. No business was transacted.

Massachusetts

The annual report of the Massachusetts Chapter has been prepared by E. W. Berchtold, Secretary, and the following officers will serve the Chapter during the coming season:

President—Leslie Clough.
Secretary-Treasurer—E. W. Berchtold.
Board of Governors—E. Q. Cole, L. A. Brissette, F. R. Ellis. C. R. Swaney, L. D. Cushman.

COMMITTEES

Papers and Meetings—E. Q. Cole, *chairman.*
Membership—L. A. Brissette, *chairman.*
Social—F. R. Ellis, *chairman.*

During the past year the Chapter held monthly meetings devoted to the following subjects:

November 28, 1932—Outline of the Work of the Engineering Bureau of the Emergency Planning and Research Bureau, by John W. Pierce, director, followed by an inspection of the Bureau Rooms.

December 12, 1932—Some Recent Air Conditioning Applications, by Paul L. Sackett.

January 9, 1933—J. S. Webb, of the Papers and Meetings Committee, recounted some of the experiences of others in securing business during these times.

February 13, 1933—The Massachusetts Chapter members were hosts to the *Boston Society of Civil Engineers,* the Boston Section of *American Society of Mechanical Engineers,* the Plant Engineers' Club and the State Engineers. Charles P. Howard, chairman of the Massachusetts State Commission of Administration and Finance, spoke on Where the Tax Dollar Goes.

March 20, 1933—A Logical Basis for Determining the Volume of Air to Be Circulated in Classroom Ventilation, by A. J. Nesbitt.

April 10, 1933—The speaker was H. B. Gill, Superintendent of the State Prison Colony at Norfolk, Mass.

May 8, 1933—The Control of Steam to a Heating System by the use of orifices, zone control and pneumatic or other regulation was discussed by Messrs. J. F. Tuttle, R. S. Twitchell, Brightman and T. F. McCoy.

Forty members are on the Chapter Rolls and arrangements have been made for the first three meetings of the fall season:

October—Insulation, by Prof. Gordon Wilks of Massachusetts Institute of Technology.

November—Panel Heating, by R. S. Franklin.

December—Reception for W. T. Jones, President of the A. S. H. V. E.

The Board of Governors met regularly each month throughout the summer to consider the best possible topics for the coming season and feel confident of increasing membership by the activities already started and the efforts of the officers.

New York

Secretary T. W. Reynolds has prepared a report of meetings held by the New York Chapter during the past season and advises that 178 members are on the Chapter Roll. The attendance at meetings is given as: October—105; November—128; December—60; January—208; February—113; March—120; April—62; May—329.

The following members are now in office:

President—H. L. Alt.
Vice-President—H. W. Fiedler.
Treasurer—W. M. Heebner.
Secretary—T. W. Reynolds.
Board of Governors—A. F. Hinrichsen, S. A. Patorno, W. W. Timmis.

A synopsis of meetings is given in the following paragraphs:

October 17, 1932—The New York Chapter opened its 1932-33 season with 72 members and 33 guests in attendance. The subject of discussion was the Mechanical Equipment of Radio City. The address was given by Ernest Williams, of the office of Clyde R. Place, on the engineering problems and their unique method of solution as applied to Rockefeller Center, commonly known as Radio City. This modern group of ten buildings, aggregating over 100,000,000 cu ft in the heart of New York City, comprises office buildings, one theatre of 8,000 seats, one theatre of 4,000 seats, possible department stores and the largest broadcasting and television studios ever designed. Mr. Williams' talk was outstanding in its simplicity, completeness and real interest and was most enthusiastically received.

November 21, 1932—Subject: A Logical Basis for Determining the Volume of Air to Be Circulated in Classroom Ventilation. A. J. Nesbitt, of the Philadelphia Chapter, spoke at considerable length in rapid Floyd Gibbons style with advanced ideas based on his extensive experimental data in classroom ventilation studies. W. H. Driscoll, chairman of the A. S. H. V. E. Ventilation Standards Committee, spoke in praise and defense of the minimum requirements in the code as the committee's impartial findings based on lengthy study, one year having passed before even one word of the code was drafted. The first introduction of the tentative code showed them by lengthy correspondence, which arrived, how far they were wrong. Dr. Leonard Greenburg, Yale University, spoke in rebuttal and commended Mr. Nesbitt's paper, Mr. Driscoll's remarks and the method adopted by the Ventilation Code Committee in handling the problem.

December 19, 1932—Subject: Man Against the Elements in a Primitive State; Strange Stories of Weird Adventures; Eternal Ice 200 Ft High, 2,000 Ft Deep. Mr. VanderVeer, speaker of the evening and a man of travel and unique experience, gave an informative account of his trip to the South Pole and the stamina required to face the hardships of the unknown on long winter nights of 100 days, where the dramatic silence is broken only by the wolf call of the dogs. He remarked that weather conditions were not so hot at the South Pole, air being fairly well conditioned, though heat registers negatively and temperature changes as much as 56 deg in eight hours. The coldest night was 72 deg below at the same time as New York experienced 96 deg above.

January 16, 1933—Subject: A Symposium on Refrigeration. The speakers were W. L. Fleisher, consulting engineer on air conditioning; C. A. Bulkeley, chief engineer, Niagara Blower Co., designer of the Bulkeley Psychrometric Chart; C. F. Holske, test engineer, American Ice Co.; R. W. Waterfill, air conditioning engineer, Carrier Engineering Corp., and E. W. Legier, assistant manager of the American Blower Corp. This was a record meeting, with an attendance of 208.

February 20, 1933—Subject: A Symposium on Automatic Controls. The speakers were W. W. Timmis, manager of C. A. Dunham Co.; G. D. Kingsland, vice-president, and E. G. McCutcheon, test engineer of the Minneapolis-Honeywell Co. It soon became evident that the matter of automatic controls has become highly specialized. The audience was unusually attentive and some discussion followed the speakers' remarks before the meeting adjourned at 11:00 p. m.

March 20, 1933—Subject: The Decline and Fall of the Business Empire. The speakers were F. L. Ackerman, architect, and Bassett Jones, consulting engineer. The material gathered and conclusions drawn were a revelation and intensely interesting. Statistics and higher mathematics were presented in volume, together with charts and curves that showed the effect of uncontrolled application of the sciences to the industries indicating why we are out of gear.

April 17, 1933—Subject: Radiant Heating. The speakers were A. L. Jaros, consulting engineer, and T. N. Adlam, mechanical engineer, formerly associated with A. H. Barker of England, who spoke on the theory and application of radiant heating in America. The remarks were accompanied by moving pictures of installations made by Mr. Jaros.

Perry West, consulting engineer, also reviewed what is being done by the Government and others to restore business conditions and suggested a committee to cooperate with the Government on the constructive side.

May 15, 1933—The season's activities were closed with the usual Annual Dinner and Entertainment at Mecca Temple, with a new record attendance of 329.

Ontario

Plans for the first three meetings of the Ontario Chapter in the 1933 fall season are announced by Secy. H. R. Roth and Members' Night is scheduled for October 2. The principal speaker will be M. W. Shears, who will discuss Safety Devices for Boilers. The second meeting on November 6 will be addressed by R. J. Thompson, Wilmington, Del., who will speak on Freon. On December 4, A. S. Leitch will be the speaker and he has chosen for his subject Present Business Conditions in the Heating and Ventilating Industry.

The annual report of the secretary states that the following members were in office during the past season:

President—J. S. Wood.
Vice-President—W. H. Boddington.
Secretary-Treasurer—H. R. Roth.
Board of Governors—M. W. Shears, W. R. Blackhall, J. S. Paterson, H. S. Moore.
Chairman of Attendance—W. P. Boddington.
Chairman of Entertainment and Publicity—E. Gauley.
Chairman of Membership—W. R. Blackhall.

The meetings held during 1932-33 are outlined as follows:

Meeting	Attendance	Speaker	Subject
October 3, 1932	21		Bowling Contest.
November 7, 1932	34	G. A. Playfair	Temperature Control Systems.
December 5, 1932	38	A. J. Nesbitt	Unit Ventilation.
February 11, 1933	24	E. H. Gurney	Business Conditions in the Heating and Ventilating Industry.
April 4, 1933	33	W. T. Jones	Society Activities.
May 2, 1933	22		Annual Meeting.

At the Annual Meeting the following officers were elected for the coming year and are now serving:

President—W. P. Boddington.
Vice-President—W. R. Blackhall.

Secretary-Treasurer—H. R. Roth.
Board of Governors—M. W. Shears, J. S. Paterson, Thomas Mcdonald, J. S. Wood.

On June 17 the Chapter held a Golf Tournament at the Weston Golf and Country Club, when 20 members and guests were present.

The annual report states that the Ontario Chapter has 45 members on its roll.

Philadelphia

The Philadelphia Chapter has made plans for the first three meetings of the new season and W. F. Smith, chairman of the Meetings Committee, has charge of arrangements. The schedule is: October 12—Atmospheric Water Cooling Equipment, J. C. Albright, speaker; November 9—Inspection of WCAU broadcasting station and air conditioning system; December 14—Steam Jet Refrigeration, F. D. Berkeley, speaker.

During the past year eight meetings were held:

Meeting	Speaker	Subject
October 4, 1932	T. A. Novotney	The Design of Cast Iron Convection Heaters.
November 4, 1932		Inspection of Penn Mutual Building, Philadelphia
December 1, 1932	A. J. Nesbitt	A Logical Basis for Determining the Volume of Air in Classroom Ventilation.
January 3, 1933	W. K. Simpson	Problems in Design of Thermostatic Traps.
February 1, 1933	Robert Daniels F. J. Maeurer	Arc Welding Pipe. **Economic Advantages** of Welded Piping in Home.
March 1, 1933	J. H. Hucker	Atmospheric Dust and Air Cleaning Devices.
April 13, 1933	R. J. Thompson	Dichlorodifluoromethane or Freon and Its Characteristics as a Refrigerant.
May 11, 1933	Dr. Edward Cattell	Golf Meeting, Roxboro Country Club.

The present officers and committees were elected in January, 1933, and will remain in office until January, 1934:

President—M. F. Blankin.
Vice-President—W. P. Culbert.
Treasurer—J. H. Hucker.
Secretary—W. R. Eichberg.
Board of Governors—M. F. Blankin, W. P. Culbert, J. H. Hucker, W. R. Eichberg, W. F. Smith, Alexander McClintock, Jr., L. C. Davidson.
Meetings Committee—W. F. Smith, *chairman.*
Membership Committee—Alexander McClintock, Jr., *chairman.*
Attendance Committee—A. H. MacDade, *chairman.*
Publicity Committee—H. H. Mather, *chairman.*
Finance Committee—F. D. Mensing, *chairman.*
Legislative Committee—J. D. Cassell, *chairman.*

Secy. W. R. Eichberg reports a membership of 131 in good standing and 15 members in arrears. The average attendance at meetings held from October to May was 55.

St. Louis

September 6, 1933—The St. Louis Chapter opened the 1933 season with a dinner meeting in the Tavern of the Kings-way Hotel, with Pres. C. A. Pickett presiding and 22 members and guests present.

The minutes of the previous meeting were read and approved and the secretary, C. R. Davis, read a letter from A. V. Hutchinson, secretary of the Society, advising the Chapter of the election to membership in the Society of H. W. McLarney, James Barry, Jr., and G. B. Rodenheiser.

J. W. Cooper, chairman of the Entertainment Committee, reported on the success of the June meeting, when an outing was held at Norwood Hills Country Club.

The chairman of the Membership Committee, Paul Sodemann, requested further efforts to increase membership in the Society due to the present rates, even though the quota of the Chapter for the year had been exceeded.

A. L. Walters, treasurer, reported a balance on hand September 1 of $364.19.

The meeting was then turned over to E. B. Evleth of the Program Committee, who introduced V. S. Beck as speaker. Mr. Beck presented a paper on Gas Conversion Burners and described their evolution, development and application. Mr. Beck also told of the results of investigations of the Research Department of Purdue University.

After considerable discussion from the floor, Mr. Evleth thanked the speaker in behalf of the Chapter for the presentation of his paper.

There being no further business, Vice-Pres. Paul Sodemann announced that the meeting was adjourned.

A review of meetings held by the St. Louis Chapter during the past year has been prepared by Secy. C. R. Davis in his Annual Report as follows:

September, 1932—This meeting was held at the David Ranken Trade School, in conjunction with the heating and ventilating class of this school. The speaker of the evening was Prof. G. L. Larson of the University of Wisconsin and chairman of the Committee on Research of the Society, who presented a paper on Some Things We Do Not Know About Heating and Ventilating. Twenty-three members and guests were present.

October, 1932—A luncheon meeting was held at the American Hotel Annex to discuss plans for a joint meeting to be held at Urbana, Ill., in connection with the Kansas City, Illinois, Wisconsin and the St. Louis Chapters. About 12 were present for the luncheon.

November, 1932—This meeting was held at the Roosevelt Hotel. The speaker was A. J. Nesbitt, Philadelphia, Pa., who presented a paper entitled A Logical Basis for Determining the Volume of Air to Be Circulated in Classroom Ventilation, together with stereopticon slides. Thirteen members and guests attended.

December, 1932—Officers and members of the Board of Governors were elected for 1933 at this meeting held at the Roosevelt Hotel. E. A. Freund presented a paper on the subject of The Air Conditioning Industry and 33 members and guests were present.

January, 1933—The meeting was held at the Roosevelt Hotel and Paul Sodemann presented a paper on Conditioning Air by the Application of Refrigeration. The attendance of members and guests was 30.

February, 1933—The meeting was held at the David Ranken Trade School in conjunction with the heating and ventilating class. The speaker of the evening was E. A. Jones, Milwaukee, Wis., who presented a paper on Domestic Air Conditioning to the 90 members and guests who attended.

March, 1933.—The meeting was held at the Benish Restaurant and C. R. Davis presented a very constructive paper on Pneumatic Temperature Control, followed by four reels of moving pictures, which were enthusiastically received by the 25 members and guests.

April, 1933—This meeting was held at the home of the *Heating & Piping Contractors St. Louis Association.* T. A. Novotney, Johnstown, Pa., presented a paper on the subject of Convection Heaters. The attendance was 25.

May, 1933—G. D. Kingsland, Minneapolis, Minn., presented a paper on Self-Contained Thermostatic Radiator Valves, followed by stereopticon slides, at a meeting when 32 members and guests assembled at the home of the *Heating & Piping Contractors St. Louis Association.*

June, 1933—In lieu of the regular meeting, the annual golf tournament, bridge and dinner dance was held at the Norwood Hills Country Club. A large number played golf, the ladies played bridge, and dancing was enjoyed until the wee small hours of the morning.

Forty-four members are on the Chapter Membership Roll and the following officers and committees are serving:

President—C. A. Pickett.
1st Vice-President—Paul Sodemann.
2nd Vice-President—J. W. Cooper.

Treasurer—A. L. Walters.
Secretary—C. R. Davis.
Board of Governors—J. M. Foster, E. A. White, G. W. F. Myers, E. E. Carlson.

COMMITTEES

Program—L. W. Moon, *chairman;* C. R. Davis, E. B. Evleth.
Entertainment—J. W. Cooper, *chairman;* G. W. F. Myers, J. M. Foster.
Membership—Paul Sodemann, *chairman;* E. E. Carlson, K. S. Wallace, G. A. Helwig, A. L. Walters.
Publicity—G. W. F. Myers, *chairman;* E. A. White, H. A. Grossmann.
Resolution—R. M. Rosebrough, *chairman;* F. J. McMorran, W. C. Sodemann.
Educational—J. M. Foster, *chairman;* L. W. Moon, Paul Sodemann.
Auditing—E. B. Evleth, *chairman;* E. A. White, J. W. Cooper.
Employment Officer—E. A. White.
Associated Engineering Societies Committee—C. A. Pickett, *chairman;* E. A. White, *counsellor;* J. M. Foster, *alternate.*

Meetings are scheduled early in the fall and will be held at the Kings-way Hotel on September 6, with V. S. Beck as speaker; October 4, when W. T. Jones, president of the A. S. H. V. E., will address the Chapter; November 1, when C. F. Stone will speak on Copper Pipe and Fittings; and December 6, when the subject of Cast Fin Type Radiators will be discussed.

Southern California

The Southern California Chapter announces the close of a very successful year under the capable leadership of L. H. Polderman. Nine meetings were held and an average attendance of 81, including guests, was maintained. In addition to the regular monthly meetings, a local convention and exhibition of air conditioning equipment was sponsored during May and was described in previous issues of the JOURNAL.

At the beginning of the year it was decided to promote an educational campaign for the enlightenment of members and guests as to the advances made in the science of air conditioning. A schedule of inter-related lectures was outlined, so that at the end of the series those who attended had a fairly composite picture of the general functions of air conditioning.

The chapter officers during the past year were as follows:

President—L. H. Polderman.
Vice-President—W. H. C. Ness.
Secretary—E. H. Kendall.
Treasurer—Leo Hungerford.
Board of Governors—F. R. Winch, J. M. LaMontagne, H. L. Warren.

The officers are indeed indebted to the following committee chairmen for the fine work which has been accomplished by the chapter during the past year:

C. S. Anderson, *chairman,* Constitution Committee.
W. H. C. Ness, *chairman,* Attendance Committee.
W. E. Barnum, *chairman,* Technical Committee.
Harrold English, *chairman,* Program Committee.
A. H. Simonds, *chairman,* Membership Committee.

and to Messrs. Barnum, Pearce and Fabling for their assistance in carrying out the program of the convention and exhibition, which was the climax of the year's activities.

Western New York

The chairman of the Program Committee, M. C. Beman, announces that A. J. Slade, North Tonawanda, N. Y., will be the speaker at the first meeting of the Chapter on October 9 and promises many other interesting technical meetings.

Chapter activities are being carried on under the following officers and committees:

President—D. J. Mahoney.
1st Vice-President—J. J. Yager.
2nd Vice-President—W. F. Johnson.
Secretary—W. E. Voisinet.
Treasurer—Wm. Roebuck, Jr.
Board of Governors—R. T. Coe, L. A. Harding, C. W. Farrar, W. G. Fraser, Roswell Farnham, M. S. Jackson, C. A. Evans, O. K. Dyer, F. H. Burke, Joseph Davis, M. C. Beman.

COMMITTEES

Program—M. C. Beman, *chairman;* W. F. Hirschman, W. B. Maloney, F. H. Sharp.
Entertainment—W. F. Johnson, *chairman;* Joseph Davis, P. S. Hedley
Membership—J. J. Yager, *chairman;* S. C. Stacy, B. C. Candee.

The annual report of Secy. W. E. Voisinet summarizes the meetings held during the past year:

October 10, 1932—This, the first meeting in fall, was made an instructive and interesting one by the speaker, Prof. G. L. Hector, of the Physics Department of the University of Buffalo. Under the title, Electronic Devices in Industry, Professor Hector dwelt mainly on the vacuum tube and photo cell. The attendance was 25.

November 14, 1932—This meeting with the high attendance of 40 was a technical session. E. L. Anderson spoke on Sound Prevention in the Heating and Ventilating Industry and covered not only fundamental physics of sound, but also offered many corrective measures for elimination of noise. Demonstrations with recording instruments made this presentation very interesting.

December 19, 1932—The Annual Xmas Stag Party was held at the University Club. Thirty five were present and time was taken from social activities to present the nominations for officers for the ensuing year.

January 9, 1933—The election of officers took place, the ticket as nominated being elected unanimously. The meeting was then turned over to T. A. Novotney, who discussed Convection Heaters. Tom, being back among old friends, certainly covered his subject well and his treatise was very worthwhile. Thirty members and guests were present.

February 18, 1933—The installation of officers took place on the occasion of the Annual Dinner Dance. It was attended by 40 members and guests and served as a means of strengthening the spirit of friendship.

March 13, 1933—This meeting, the first under the new administration, was held as usual at Gandy's and, after committee appointments, Pres. D. J. Mahoney presented the speaker, J. W. Spencer. Mr. Spencer's talk on Refrigeration in the Air Conditioning Industry thoroughly covered cooling water by means of the steam ejector principle and proved instructive to everyone.

April 3, 1933—A record attendance turned out to hear the president of the Society, W. T. Jones, Boston, Mass., who presented an inspiring message on The Status Quo of Engineering. This visit did much to enlighten the Chapter on Society activities and gave the members courage to carry on.

May 8, 1933—This marked the last technical gathering of the season and C. A. Bulkeley, New York, N. Y., very interestingly discussed Air Conditioning by the Surface Method. Mr. Bulkeley's long and varied experience made this timely subject very instructive to the 45 members and guests who were present.

The annual June Dinner Dance was abandoned and a few informal golf meetings were arranged throughout the summer in cooperation with the Western New York Trade Golf Association.

Western Michigan

When members of the Western Michigan Chapter meet on October 9, they will be addressed by R. J. Thompson, who will speak on The Refrigerant Freon. Plans have also been made for a November 13 meeting with T. A. Novotney as guest speaker, discussing the Design of Convectors.

The following officers and committee members are now serving the chapter, which numbers 23 members on its roll:

President—K. L. Ziesse.
Vice-President—S. H. Downs.
Secretary—P. O. Wierenga.
Treasurer—Harry Christenson.
Board of Governors—W. W. Bradfield, J. J. Troske, Cornelius Lammers.

COMMITTEES

Speakers and Educational—W. W. Bradfield, *chairman;* Harry Christenson, J. F. Johnston, Jr.

Entertainment and Program—Cornelius Lammers, *chairman;* W. J. Temple, C. H. Alexander, W. G. Schlichting.

Reception—J. J. Troske, *chairman;* C. R. McConner, C. H. Morton.

Membership and Attendance—H. F. Reid, *chairman;* J. H. Van Alsburg, J. S. Skillman.

Employment Representative—C. R. McConner.

Publicity—O. D. Marshall, *chairman;* J. J. Troske.

A synopsis of meetings held during the past season is contained in the annual report of Secy. P. O. Wierenga:

October 11, 1932—Speaker—S. H. Ranck, city librarian, whose topic was Heating and Ventilating Problems of a Public Building. Attendance—11 members and 11 guests.

November 14, 1932—Speaker—S. S. Sanford, whose subject was Field Study in the Cooling of Office Buildings. Attendance—13 members and 12 guests.

December 12, 1932—Speaker—A. J. Nesbitt, whose subject was A Logical Basis for Determining the Volume of Air to Be Circulated in Classroom Ventilation. Attendance—16 members and 17 guests.

January 9, 1933—Speaker—B. Parks, consulting and mechanical engineer of the new Civic Auditorium, whose personally conducted tour through the building and his explanations of the various mechanical features made this one of the outstanding meetings of the year. Attendance—19 members and 33 guests.

February 13, 1933—A joint meeting with Peninsular Section of the *A. S. M. E.*, at which Dr. C. F. Hirshfeld was the speaker, Attendance—17 members and 4 guests.

April 7, 1933—Speaker—Pres. W. T. Jones, A. S. H. V. E., whose subject was The Status Quo of Engineering. Attendance—11 members and 7 guests.

Wisconsin

The Wisconsin Chapter activities during the 1932-33 season have been summarized in the annual report of Secy. C. H. Randolph, who reports that 36 members are now on the Chapter Roster.

Following are listed the officers and committee chairmen:

President—V. A. Berghoefer.
First Vice-President—J. S. Jung.
Second Vice-President—Ernest Szekely.
Secretary—C. H. Randolph.
Assistant Secretary—A. F. Bowers.
Treasurer—M. E. Erickson.
Board of Governors—G. L. Larson, J. G. Shodron, E. A. Jones.

Program Committee—Ernest Szekely, *chairman.*
Membership Committee—C. H. Randolph, *chairman.*
Nominating Committee—J. H. Volk, *chairman.*

A synopsis of meetings held during the year is also given:

September 26, 1932—Held at the Ogden Cafe, when the election of officers took place. Principal speaker was Mils Laborich, local assistant meteorologist, who discussed The How and Why of Wisconsin Weather Conditions.

October 31, 1932—Held at the Ogden Cafe. Principal speaker was H. Sloan, who spoke on Rotary Compressors.

November 23, 1932—Held at the Plankinton Hotel. Later the meeting adjourned to the auditorium of the Milwaukee Electric Railway and Light Co. and joined the members of the Electrical League of Milwaukee. Oscar Werwath, president of the Milwaukee School of Engineering, gave an experimental demonstration of modern electricity.

December 14, 1932—Held at the Pfister Hotel. Principal speaker was A. J. Nesbitt, whose subject was A Logical Basis for Determining the Volume of Air to Be Circulated in a Classroom.

January 6, 1933—Held at Pfister Hotel. Principal speaker was Prof. F. B. Rowley, University of Minnesota, on Relation of Building Construction to Air Conditioning.

February 20, 1933—Held at the Pfister Hotel. Principal speaker was R. F. Norris, Burgess Laboratories, Madison, Wis., who spoke on Acoustical Treatment of Mechanical Installations and Ventilating Systems.

March 20, 1933—Held at the Pfister Hotel. Lantern slides on Air Strain and Sound Waves, supplied by the *A. S. M. E.*, were shown.

April, 1933—A joint meeting of the Minnesota, Illinois and Wisconsin Chapters was held at LaCrosse, Wis.

May 22, 1933—Held at the Pfister Hotel. Eugene D. Milener, *American Gas Association*, discussed Domestic Air Conditioning.

June 8, 1933—The annual picnic was held at the Chalet.

July 12, 1933—A special meeting was held on the roof of the Shorecrest Hotel, when R. J. Thompson spoke on Refrigerants.

Niagara Frontier Power Conference

During the week of August 28 the Niagara Frontier Power Conference was held at the Hotel Statler, Buffalo, N. Y., and a mechanical exposition under the auspices of the *National Association of Power Engineers* was a feature.

L. A. Harding, president of the *Engineering Society of Buffalo*, was honorary chairman of the conference. Among the papers of special interest were those contributed by W. H. Carrier, Newark, N. J., on Air Conditioning in Relation to Public Utilities, A Survey of Refrigeration Progress by D. L. Fiske, secretary of the *A. S. R. E.*, and Modern Steam Power Plant Equipment by C. R. Soderberg.

Many of the members of the Western New York Chapter of the A. S. H. V. E. attended the opening session. D. J. Mahoney, president of the chapter, was active in the group of engineering societies which cooperated in carrying out the elaborate technical and entertainment program.

Death of William T. Smallman

Members of the Society and friends of William T. Smallman will learn with regret of his sudden death at his home, 127 Rockland Ave., Malden, Mass., on September 17, 1933, at the age of 75. Mr. Smallman was a Life Member of the A. S. H. V. E., which he joined in 1911, and was a prominent club member and welfare leader in the community in which he lived.

Born at Alexandria, Prince Edward Island, he received his early education in the public schools of Cambridge. From 1879 to 1890 he was connected with Drew & Coffin in Boston, where, after obtaining drafting and shop experience, he acted as superintendent of construction. His life was spent in heating and ventilating work and from 1890 to 1905 he was a partner in the firm of Isaac Coffin & Co., Boston, then served as treasurer of Isaac Coffin Co., 52 Sudbury St., Boston, Mass., from which he recently retired.

Mr. Smallman was also a member of the Mt. Vernon Lodge, A. F. & A. M., the Melrose Council of Royal and Select Masters of Malden, the Tabernacle Royal Arch Chapter of Malden, the Pilgrim Fathers, and the New England Order of Protection.

He was prominent in the affairs of the First Universalist Church of Malden of which he was a deacon, a member of the men's club, and at one time superintendent of the Sunday School. He was active in welfare work, keeping close contact with the Y. M. C. A., the Boy Scouts and the Red Cross and last year was president of the Malden Chapter.

Mr. Smallman is survived by his widow, Mrs. Jennie G. Smallman, a daughter, Mrs. Harry L. Schofield of Cranston, R. I., and two sons, Edward W. Smallman of Washington and Clinton I. Smallman of Elizabeth, N. J.

Funeral services were held at the First Universalist Church with interment in Yarmouth.

The officers and members of the Council wish to express their sincere sympathy to the members of his family in their bereavement.

CANDIDATES FOR MEMBERSHIP

The Constitution of the Society as now amended, requires the following mode of procedure in voting on applicants for membership in the Society. All applications for membership are to be sent to the Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society or sent to the members in other approved manner as ordered by the Council. When replies are received from references, the Candidate's application shall be submitted to and acted upon by the Membership Committee as soon as possible.

When the Membership Committee has acted favorably upon a Candidate's application and assigned his grade, the Council shall vote upon the election of the proposed Candidate for membership by letter ballot. During the past month 9 applications for membership have been received and the names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Membership Committee, and in turn the Council, urge the members to assume their share of the responsibility of receiving these candidates into membership by advising the Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some members by October 16, 1933, these candidates will be balloted upon by the Council. Those elected to membership will be notified by the Secretary immediately after election.

CANDIDATES	REFERENCES	
	Proposers	*Seconders*
BURNS, ROBERT, Htg. Engr., Ochiltree Elec. Co., Pittsburgh, Pa.	F. R. Still	J. I. Lyle
	Arthur Ritter	W. L. Fleisher
COLCLOUGH, OTHO T., Custodian, Legation of the U. S. A., Ottawa, Canada.	J. H. Foote (*A.I.E.E.*)	J. R. North (*A.I.E.E.*)
	E. V. Sayles (*A.I.E.E.*)	W. J. Ducey (*A.I.E.E.*)
D'IMOR, ELTON J., Br. Mgr. and Engr., The Trane Co., Memphis, Tenn.	F. J. Rentschler (*Non-Member*)	J. C. Trefts, Jr. (*Non-Member*)
	J. C. Trefts (*Non-Member*)	E. R. Downs (*Non-Member*)
EGGLY, HARRY J., JR., Consulting Engr., Ocean City, N. J.	W. P. Culbert	A. McClintock, Jr.
	W. R. Eichberg	J. L. Clodfelter
HOLLISTER, NORMAN A., Air Cond. Engr., 7101 Colonial Rd., Brooklyn, N. Y.	G. S. McEllroy	F. A. Gunther
	L. B. Pittock	J. L. Blackshaw
HUFFAKER, HERBERT B., Htg. Engr., Dail Steel Products Co., Lansing, Mich.	L. G. Miller	H. B. Dirks (*A.S.M.E.*)
	J. H. VanAlsburg	S. H. Downs
RENOUF, E. PRINCE, Sales Engr. & Dist. Supervisor, Carrier Corp., Dallas, Tex.	T. M. Cunningham	G. H. Meffert
	F. C. Hersh	L. L. Landauer
RYAN, WILLIAM F., Sales Engr., Lee Hardware Co., Salina, Kans.	C. W. Adams	W. E. Gillham
	W. A. Russell	Carl Clegg
WHITELEY, STOCKETT M., Consulting Engr., Baltimore, Md.	F. C. Dorsey	D. D. Zink
	E. K. Campbell	E. K. Campbell, Jr.

Candidates Elected

In past issues of the JOURNAL of the Society the names of t he following men were listed as Candidates for Membership. The membership grade of each Candidate has been assigned by the Membership Committee and balloted upon by the Council. We are now instructed by the Council to post herewith, as required by Art. II, Sec. VIII, of the By-Laws, the following list of candidates elected:

MEMBERS

BARNES, WALTER F., Pres., Barnes & Jones, Inc., Jamaica Plain, Mass.

BELL, E. FLOYD, Dist. Mgr., Buffalo Forge Co., Minneapolis, Minn.

BOUILLON, LINCOLN, Consulting Engr., Seattle, Wash.

BOYLE, WALTER W., Consulting Engr., Pittsburgh, Pa.

COLLINS, JOHN F. S., JR., Supervisor of Steam Installations, Allegheny County Steam Htg. Co., Pittsburgh, Pa.

GOODWIN, WALTER COOK, Div. Engr., Air Cond. Equip. Div., Supply Engrg. Dept., Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

HARTWEIN, CHARLES E., Htg. Engr., St. Louis County Gas Co., St. Louis, Mo.

HERTY, FRANK B., House Htg. Supervisor, Bklyn. Union Gas Co., Brooklyn, N. Y.

MCCORMACK, DENIS, Mgr., Air Cond. Dept., Julien P. Friez & Sons, Inc., Baltimore, Md.

MILLER, LORIN G., Prof. Mech. Engrg., Michigan State College, East Lansing, Mich.

SWANSON, HARRY, Engr., The Fels Co., Portland, Maine.

ASSOCIATES

LYNN, JOHN HENRY, Bldg. Supt. & Chief Engr., Dallas Power & Light Co., Dallas, Texas.

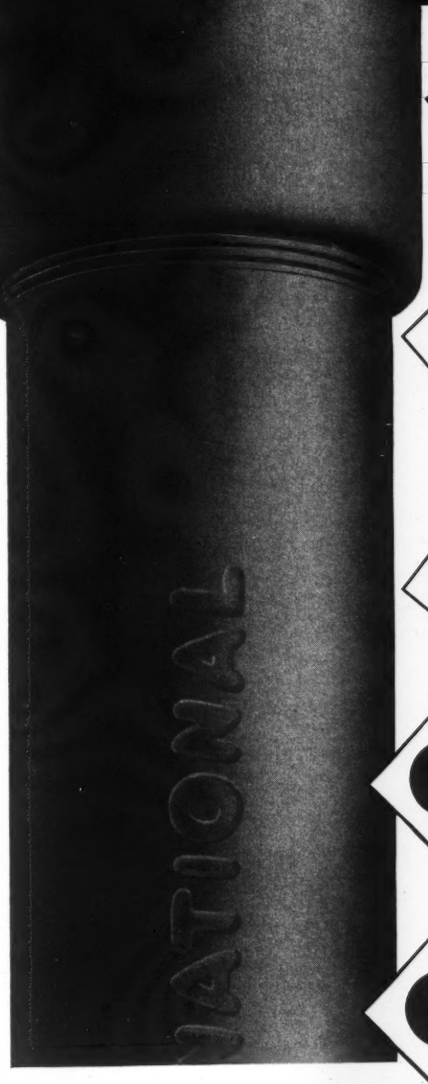
OBERG, HARRY CHRISTIAN, Mgr., Engrg. Dept., Crane Co., St. Paul, Minn.

JUNIORS

CAMPBELL, ALFRED QUINCY, JR., Salesman, E. K. Campbell Htg. Co., Memphis, Tenn.

DEELY, JAMES J., Sales Engr., Brooklyn Union Gas Co., Brooklyn, N. Y.

THESE 10 POINTS leave no doubt that National is America's Standard Wrought Pipe



1 UNIFORMITY
NATIONAL Pipe offers uniformity of metallic structure, of ductility, of strength, of resistance to corrosion.

2 STRENGTH AND DUCTILITY
Strength and ductility to a remarkable degree are inherent in the steel of NATIONAL Pipe.

3 THREADS EASILY
Smooth, strong, easily made threads are a marked advantage in using NATIONAL Pipe.

4 FLANGES READILY
Flanging without loss of material, time, or labor is an experience which practical men appreciate.

5 COILS AND BENDS WELL
There is satisfaction and profit in using a pipe that meets the demands of unusually close and exacting work.

6 SOUND JOINTS
Workmen who have welded or coupled thousands of joints on NATIONAL Pipe, enthusiastically endorse it.

7 COPPER-STEEL
National Tube Company introduced Copper-Steel Pipe to industry twenty years ago. Therefore, NATIONAL is the original Copper-Steel Pipe.

8 SCALE FREE
The Scale Free Process is a special method by which all NATIONAL Pipe (butt-weld sizes ½ to 3-inch) is freed of mill-scale, inside and outside.

9 SPELLERIZED
Another special process applied to sizes 4-inch and under, which results in a lessened tendency to corrosion.

10 TESTED AND INSPECTED
Tests and inspections, the most painstaking, most thorough and most conclusive are applied to all NATIONAL Pipe.

Chromate Treatment—All NATIONAL *Galvanized Pipe is given a special chromate treatment to resist discoloration and the formation of white rust. This patented process preserves that smooth, glistening surface or metallic lustre which is characteristic of good galvanizing.*

NATIONAL TUBE COMPANY · Pittsburgh, Pa.
Subsidiary of United States Steel Corporation

NATIONAL PIPE

What's this..
Just Another Unit Heater?
Not by a long shot!
See this NEW REXVANE FAN
It cuts Motor Horse Power in Half
And this NEW LEAK-PROOF Heater
Just try to break one of the joints!
INVESTIGATE THESE AND OTHER FEATURES
Write for Catalog 395 and Complete Data
B. F. Sturtevant Co., Hyde Park, Boston, Mass.
Sturtevant
REG U S PAT OFF

Conventions and Expositions

American Welding Society: Fall meeting, October 2-6, Book Cadillac Hotel, Detroit, Mich. Headquarters Office, 29 W. 39th St., New York City.

National Association of Better Housing: Organization meeting, October 31 and November 1, Union League Club, Chicago. Secretary, Henry A. Guthrie, 59 East Van Buren Street, Chicago.

National Association of Practical Refrigerating Engineers: Annual convention and educational exhibition, November 8-11, Roosevelt Hotel, New Orleans, La. National Secretary, Edward H. Fox, 435 N. Waller Ave., Chicago.

American Society of Refrigerating Engineers: Annual meeting, December 6-8, Hotel New Yorker, New York City. Secretary, David L. Fiske, 37 W. 39th St., New York.

Joint Meeting, Air Conditioning in Industry: Popular forum on air conditioning sponsored by *A.S.M.E.* and *A.S.R.E.* during meetings of the Societies in New York, first week in December.

American Society of Heating and Ventilating Engineers: Annual meeting, February 5-8, New York City, Secretary, A. V. Hutchinson, 51 Madison Ave., New York City.

International Heating and Ventilating Exposition: Third exposition, February 5-9, 1933, Grand Central Palace, New York City. Charles F. Roth, Manager, International Exposition Co., Grand Central Palace, New York City.

American Oil Burner Association: Annual meeting and oil burner show, Philadelphia, Pa. (Dates to be announced.) Secretary, Harry F. Tapp, 342 Madison Ave., New York City.

New Book on Oxy-Acetylene Pipe Welding

Most helpful to anyone concerned with industrial or building piping is the 160-page book *Fabrication of Oxwelded Piping* which has just been published by The Linde Air Products Company. It is divided into four parts, the first covering fundamentals of pipe welding, procedure control for oxy-acetylene welding joints in steel or wrought-iron pipe, layout and fabrication of welded piping, welding practices for long pipe lines, welding practices for building and industrial piping, and qualification tests for welders.

Part II is devoted to templet layout for welded fittings, and Part III to tables for estimating costs.

Welding of cast-iron and non-ferrous piping is the subject of Part IV; sections are included on cast iron, copper and brass, and lead.

This book contains much material not available from other sources; its usefulness is contributed to by some 20 ready-reference tables and the 75 illustrations. Copies are available without charge to the readers of HEATING, PIPING AND AIR CONDITIONING and may be had on request to The Linde Air Products Company, Technical Publicity Department, 205 E. 42nd St., New York City.

Government Circular on Acoustical Insulation

In *A Discussion of Some of the Principles of Acoustical Insulation,* by V. L. Chrisler, a consideration of the factors which control the transmission of sound through partitions is given. Impact noises, and the methods of insulating against them, receive special attention. It is pointed out that a small opening may almost completely destroy the sound-insulating value of a wall. It is also shown that in the presence of a noise a wall which is a poor sound insulator may appear to be fairly good. Homogeneous and non-homogeneous walls are considered in separate sections.

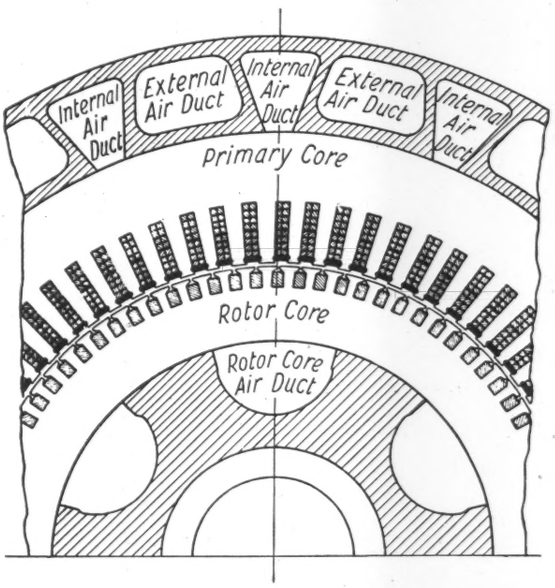
This publication, a twelve-page pamphlet, is designated as Bureau of Standards Circular No. 403. It is available from the Superintendent of Documents, Washington, D. C., for 5c.

(*From page* 520)

Dual Ventilation Aids Totally-Enclosed Motors;

Recently, the Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa., has perfected a scheme of ventilation which makes possible enclosed motors up to 200 hp with mounting dimensions comparable to open types. Internal and external air is circulated by fans through paths which cause rapid transfer of heat from the internal air to the frame and from the frame to the external air.

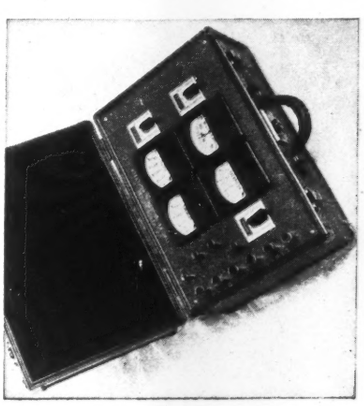
The frame contains two sets of ducts. The first set runs from one end of the frame to the other, inside the motor. The internal ventilating air is drawn by the internal fan through the air gap



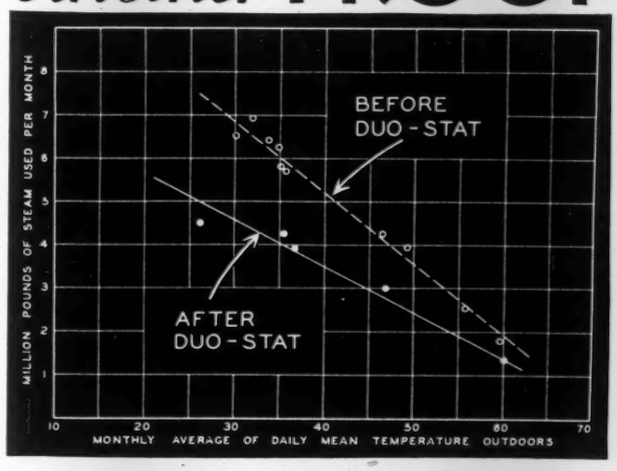
and rotor core vent holes, and is driven through the stator and turns and through the internal ducts over the stator core. When the motor is assembled the internal air is sealed within the motor. The second set of ducts alternate with the first and pass from each end to the center of the motor. Double-end ventilation is used on the larger machines. Since the ducts carry external air in close proximity to the internal air there is a heat-exchanger effect. The internal fan on the rotor of the motor causes a continuous internal flow of air so that there are no dead air spaces and heat is continuously carried away from the electrical parts.

The motors are suitable for refineries, for agitators, hot-oil pumps, gasoline pumps, centrifuges, gas boosters and other class *I* group *D* hazardous locations.

A new portable a-c testing set, known as the industrial analyzer and suitable for testing industrial apparatus and motors up to 100 hp, 440 volt has also been announced by Westinghouse. Capable of making complete tests up to 125 amperes, 500 volts a. c., the analyzer is in reality a miniature portable three-phase switchboard panel in a carrying case complete with all necessary switching equipment, transformers, and resistors. The unit contains a triple-scale ammeter 0-5, 0-25, and 0-125 amperes, a triple-range voltmeter 0-150, 0-300, and 0-600 volts, a polyphase watt-



Another PROOF


MILLION POUNDS OF STEAM USED PER MONTH
BEFORE DUO-STAT
AFTER DUO-STAT
10 20 30 40 50 60 70
MONTHLY AVERAGE OF DAILY MEAN TEMPERATURE OUTDOORS

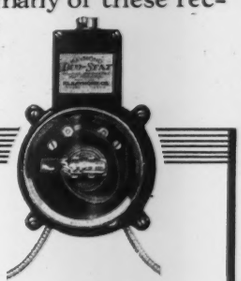
—an accurate picture of DUO-STAT SAVINGS *in the* HEARST BUILDING of Chicago

IT was even more than we had hoped for! In exactly six weeks the Raymond Duo-Stat in the Hearst Building, Chicago, had *paid* for itself. The story of this big cut in steam costs is shown above in the simplest possible way—by simply plotting steam used per month against the daily mean temperature outdoors.

If this were the only record of its kind you would have a right to question it. But the record of the Hearst Building is merely one leaf of a great volume of evidence for the Raymond Duo-Stat. We have charted many of these records in the same way that the Duo-Stat record in the Hearst Building is pictured above. Have you received a set of these charts?

What would the picture of Duo-Stat savings be in the building, or buildings, in which you are interested? We will gladly chart this for you if you will simply supply a record of steam or fuel consumption (by months) for the last year. We have prepared many charts of this kind, and the theoretical steam saving that they show has invariably been exceeded by actual performance in those cases where the Duo-Stat was later installed.

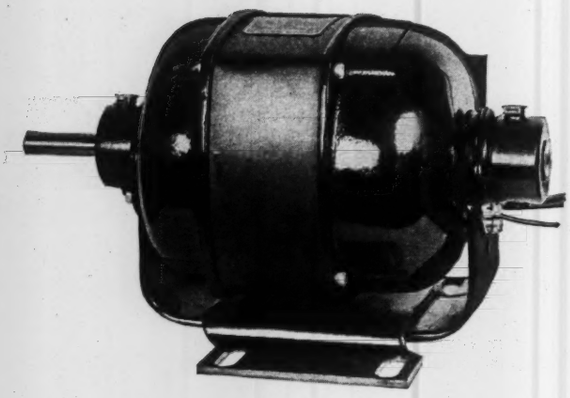
F. I. RAYMOND CO.
629 W. Washington Blvd.
CHICAGO, ILL.



The DUO-STAT *alone combines these features*

- Controls room temperature by a combination of outside and radiator temperature. (A fully protected principle.)
- Is just as effective with one-pipe system as two-pipe system.
- Accomplishes partial filling of radiators in either a one-pipe or two-pipe system.
- Cannot be upset by open windows.
- Gives a modulated control that can only be described as Duo-Stat modulation.

RAYMOND DUO-STAT



FOR STOKER DRIVE

Leland designers "cut the Gordian Knot" even as did Alexander the Great, when they departed from conventional motor designs and developed the Leland stoker drive.

In it the stoker designer is assured of a motor that is:

Proof against ashes and dirt — totally enclosed

Proof against inherent motor noises—flexibly mounted

Proof against transmission of vibration —flexibly mounted

Able to break loose the heavy starting load incidental to stoker operation.

Able to withstand stalled loads for reasonable periods.

Able to handle temporary overloads.

Designed to operate within normal temperature limits, but may be fan cooled to meet abnormal conditions.

Get one and test it. Its performance, particularly when in competition with other designs, will prove its adaptability.

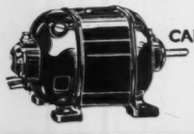
Other Leland designs in ratings of 1/8 to 3 h. p. for a wide range of applications; also a geared head line.

Send for literature on the design in which you are interested.

1/8 1/6 1/4 1/3 1/2 3/4 1 1½ 2 3

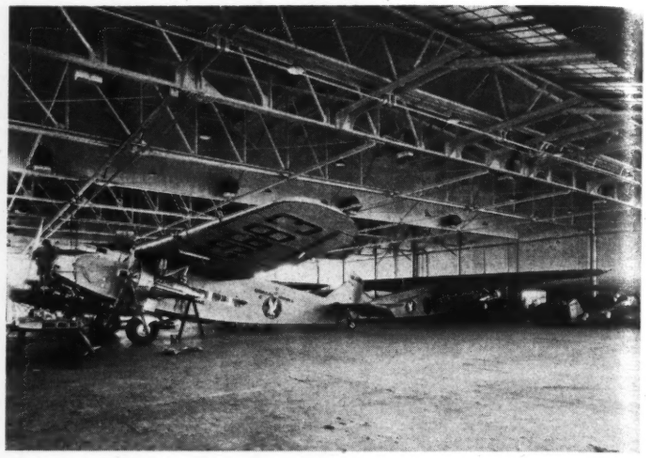
THE LELAND ELECTRIC CO.
DAYTON · OHIO · U·S·A

CANADIAN ADDRESS TORONTO



CABLE ADDRESS LELECT·

Leland Motors



Buffalo Suspended GAS Unit Heaters in new Hangar of American Airways, Fort Worth, Texas

Hangars heated economically with "Buffalo" GAS Heaters

When the huge hangar of American Airways was built at Fort Worth, Texas, Buffalo Gas Unit Heaters were selected to provide heat.

These units cost considerably less than a steam heating system, provide practically instant heat when needed, require no fuel storage or boiler room, and are very clean. They have an efficiency of about 90%.

Because they cost less to buy and to operate than a new steam heating system, Buffalo GAS Unit Heaters are being installed in many industrial buildings. Quotations and estimates on heating with Buffalo Gas Unit Heaters will be sent on receipt of dimensions, construction details and gas rates. Investigate before you buy any unit heaters.

Buffalo Forge Company
171 Mortimer St., Buffalo, N. Y.
In Canada: Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

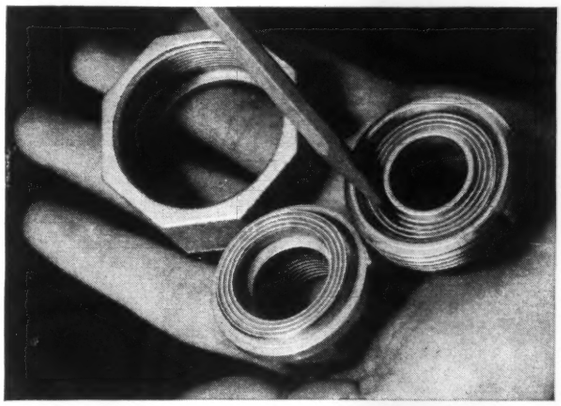
"Buffalo" GAS Unit Heater for CLEAN, quick heat

meter with three scales for the above voltage and current ranges and a polyphase power-factor meter with 10-100-80 scale to operate on the above voltages and currents. The instruments are of a newly-designed miniature type with standard-size mechanism having high overload capacity and low energy consumption. The scales of the instruments are 3½ in. long.

An Improved Union

An improvement in high-pressure union design for steam, oil, gas, water and air lines, is featured in a new product, the U. S. Union, manufactured by the Mergenthaler Linotype Company and distributed through its subsidiary, the United Superior Union Company, according to a recent announcement.

The new union has two serrated ends, one hard and the other soft, which form four distinct seats. The unions can be used a



number of times, as a single "making-up" cannot spoil the four separate seats. These unions are made both in black and cadmium plated. With cadmium plating the union is machined first and then the cadmium applied inside and out.

The unions have been tested by users in the public utility, petroleum, transportation, marine and industrial fields and have given excellent service under all conditions, including installations where there is vibration or unusual variations of temperature and pressure, says the manufacturer.

Introduces New Pulleys

The Congress Tool and Die Company, Detroit, Mich., has announced the introduction of a new series of pulleys in a large variety of sizes, which are designed accurately to fit *A* and *B* type belts for power-transmission needs. According to the maker, they are "built to the belt" to insure long belt life and economy of operation through efficient transmission of power. The pulleys are die cast from white brass, are diamond bored and balanced to eliminate virbration at high speeds.

Weld Testing Service

Announcement has been made by the Pittsburgh Testing Laboratory, Stevenson and Locust Sts., Pittsburgh, Pa., of the establishment of a national weld testing bureau. Among the primary objectives of the service offered by this bureau is to assist the manufacturer, fabricator, or contractor to comply with such specifications, codes, or rules as have been adopted or might be adopted in so far as they relate to welding. James W. Owens is the director.

Develops Humidity Control

The Penn Electric Switch Co., Des Moines, Iowa, has developed a new humidity control, for operating small fans, valves, etc., in commercial or domestic service. It is housed in a wal-

Air washer in Philadelphia Savings Fund Society Building, insulated with Corinco Cork Covering

Exterior of Philadelphia Savings Fund Society Building

ONLY THE BEST INSULATION
for this Important Air Conditioning Installation

The management of the largest and finest air-conditioned office building in Philadelphia took no chances with inferior insulation to protect their air-conditioning system from impure air. They accepted Corinco Cork Covering to obtain the maximum efficiency from their conditioning equipment. The air washer and ducts were insulated with Corinco Corkboard at all points where they were in contact with unconditioned air to prevent condensation of moisture on the pipes inside the covering.

Likewise the roof of the building was completely insulated with one layer of two inch Corinco Corkboard. Approximately 125,000 feet of Corinco Corkboard and also several thousand dollars of Corinco Cork pipe covering were used in this building.

Not only is Corinco made of pure-baked, perfect materials, but scientifically erected by our experienced workmen under the direction of an expert Corinco engineer.

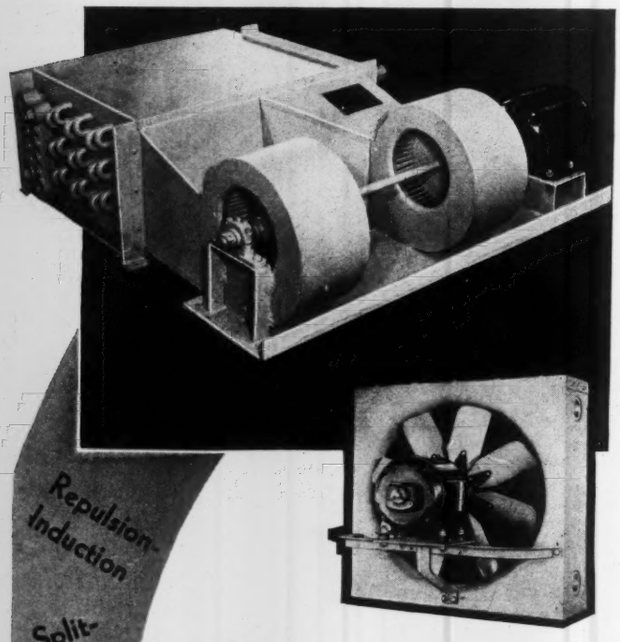
That's why you can be certain of the greatest insulation efficiency at the lowest cost when Corinco is used.

Descriptive catalog mailed on request.

CORK INSULATION CO., INC.
154 NASSAU STREET NEW YORK, N.Y.
BRANCHES IN PRINCIPAL CITIES
FACTORY, WILMINGTON, DELAWARE
Manufacturers of Sheet Cork, Cork Pipe Covering and Granulated Cork

WAGNER

Motors for Air Conditioning



Repulsion-Induction

Split-Phase

Capacitor

Direct-Current

Squirrel-Cage

Fynn-Weichsel Synchronous

THE motors operating the cooling units illustrated above, are Wagner motors.

The upper unit is a railroad-car cooler, operated by a direct-current motor; the lower unit is a suspended-type room-cooler, utilizing a split-phase motor.

Other types of motors Wagner builds for air conditioning machinery are: capacitor, squirrel-cage (3-phase and 2-phase), repulsion-start-induction — and, on large jobs, the powerfactor-correcting Fynn-Weichsel synchronous motor.

Whatever your motor-driven product may be, there's a type of Wagner motor available to drive it.

Wagner Electric

WAGNER ELECTRIC CORPORATION, M333-7
6370 Plymouth Ave., St. Louis, U. S. A.

Please send literature on the types of Wagner motors checked below.

Name & Position

Firm

Address

☐ Repulsion-induction ☐ Split-Phase ☐ Capacitor ☐ Squirrel-Cage ☐ Fynn-Weichsel

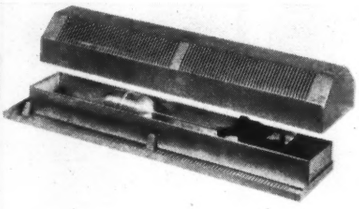
nut brown molded bakelite case with a thermometer on the face of the cover.

The sensitive element is produced by winding a specially-prepared paper strip around a corrugated spiral. One end of the strip is adjustable by means of a small tension screw while the other end is fixed to the spiral. The free spiral end moves an armature to open and close an electric circuit.

By a method of mounting the paper element, strain at high humidity or temperature is eliminated. At low humidity or temperature the design is such that the instrument is not thrown out of calibration. An adjusting lever makes for ease in setting the control for operation at various relative humidities.

An Automatic Humidifier

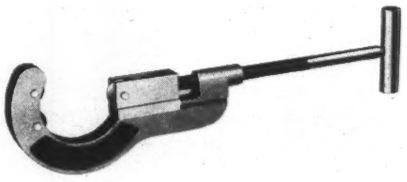
An automatic humidifier for exposed or concealed radiators and furnaces has been developed by the Bon-Air Radiator Corp., Boston, Mass. It is designed to meet the needs of an individual room or office. For cast-iron radiators the humidifier is available in 6 and 8-in. widths in several lengths; for furnaces and concealed radiators in 4 and 6-in. widths in several lengths.



Water level is controlled by a float as illustrated.

Two New Cutters

A wheel cutter for copper tubing ⅛ to ¾ in. has been announced by The Borden Company, Warren, Ohio; it is designed to produce clean square ends without crushing and has a renewable blade-reamer. Length is 6 in. and weight 9 oz.



Also announced by this company is a square-built wheel cutter (three wheels, 2½ in. to 4 in. sizes) with all parts built at exact right angles to give definite assurance of "tracking."

Lubricant for Pipe Threads, Etc.

A new lubricant has been developed in which metallic lead is the protective element. The lead has been broken down into such finely divided parts as to be virtually a soluble or liquid lead within a lubricant vehicle. The new product, known as "Bestolife," forms a thin protective film of lead on all contacting surfaces which changes such surfaces to a continuous unbroken, antifrictional area, according to the manufacturers, Armite Laboratories, 1450 E. 61st St., Los Angeles, Calif. The lubricant has a pure metallic lead base and is said to be free from chemical reactions.

The minimum constituency of lead in this lubricant is 10 per cent, ranging up to 65 per cent, and is claimed to withstand temperatures up to 430 F, not losing entirely its lubricating stability until the melting point of lead (590 F) is reached. Applications include use as a pipe thread lubricant, for pump and valve stem packing, plug cocks, gears, bearings and belt dressing.

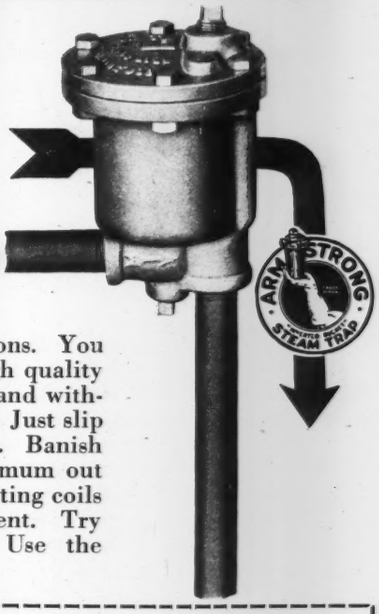
The OLD MELTER *has no* SUBSTITUTE

BECAUSE there is no substitute for experience . . . Old Jerry, watching his melt in one of our open hearth furnaces, stands as a most engaging symbol of the experience, skill and care paid to Harrisburg manufactories, from pig to finished product . . . Our Engineering and Metallurgical Departments plan each heat of steel to suit a particular product . . . Harrisburg products: Open Hearth Steel; Drop and Hollow Forgings; Steel Pipe Flanges; Seamless Steel Gas Cylinders. Pipe Couplings, Pump Liners and Bull Plugs; Pipe Coils and Bends; Feed Water Heaters.

HARRISBURG PIPE & PIPE BENDING CO., Harrisburg, Pa.

From Pig to Finished Product

Now you can TURN THE CORNER with an ARMSTRONG TRAP



This new No. 201 Armstrong—the latest addition to the greatest line of steam traps—is the same as the No. 100 except for the body. It's only a handful in size, but it has an actual capacity between 400 and 700 lbs. of condensate per hour at differential steam pressures between 5 and 80 lbs. per sq. in. Maximum pressure handled, 125 lbs. Like the No. 100 it can be furnished with an automatic air by-pass, giving exceptionally high air handling capacity.

The No. 201 is distinguished by its angle connection, which simplifies both new and replacement installations. You can now get the Armstrong high quality trapping service at a low cost and without any piping rearrangement. Just slip out the old and slip in the new. Banish trap trouble and get the maximum out of every pound of steam in heating coils and small steam-using equipment. Try this trap at our expense. Use the coupon.

ARMSTRONG MACHINE WORKS
874 Maple St.
Three Rivers, Mich.

ARMSTRONG MACHINE WORKS,
874 Maple Street, Three Rivers, Mich.
Gentlemen: Please send.....Armstrong traps with the angle connection. I will use them for 90 days and return them at your expense. This involves no obligation. Maximum steam pressure ..... Approximate amount of condensate per hour ..... Type of equipment to be drained.....

Name .....
Position .....
Company .....
City ..... State.....

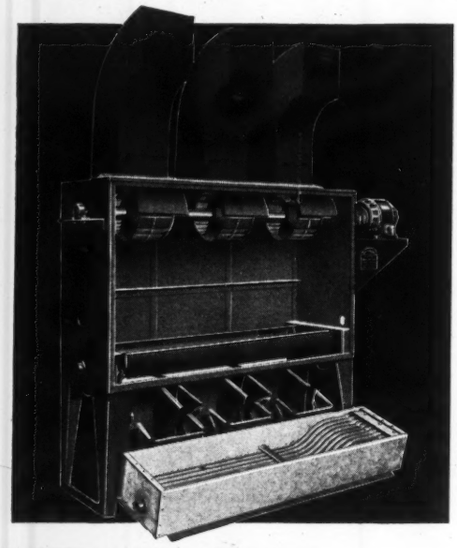
HP&AC10Gray

We Could Have Skimped on Quality
—*BUT WE DIDN'T!*

DURING the last few years it was quite the thing to cut corners on quality, in order to cut prices and meet competition. But we didn't fall in line. Instead, we kept on with our research and development—building up, not tearing down.

Today, therefore, when you purchase CLARAGE UNITHERM UNIT HEATERS—at fair prices—you get every advantage and refinement. For instance: SYNCHROTHERM CONTROL (by means of automatic by-pass dampers), Greater B.t.u. Capacity, Self-limiting Horsepower Characteristics, etc.

Whether your heating job is small or large, CLARAGE UNITHERMS will give you satisfactory results with utmost economy. Write for complete information. CLARAGE FAN COMPANY, Kalamazoo, Michigan.



NRA MEMBER U.S. WE DO OUR PART

As shown at left, the coil is removable through the front of unit. Also note that fan housings are removable. Thus every part is accessible—easy to get at. Clarage Unitherms are designed for high or low pressure steam in a wide range of sizes.

CLARAGE
UNITHERM UNIT HEATERS

The Company You Keep

A year's subscription to this journal will prove one of the most valuable investments you have ever made. Send your name and address and your check for $2.00, or, if you wish, we will bill you later.

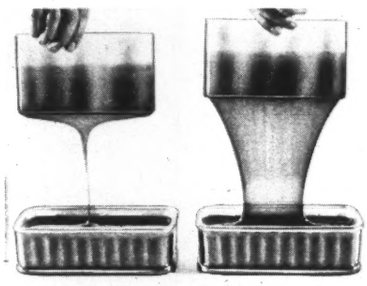
When your name appears on the reader lists of HEATING, PIPING *and* AIR CONDITIONING, it is among the names of the important men handling this work in the big office buildings, hotels, theatres, hospitals, public utilities, central heating stations, etc., etc.

The problems of these men are like your own. The data and information which the pages of HEATING, PIPING *and* AIR CONDITIONING bring to you each month will help greatly in solving those problems.

HEATING, PIPING *and* AIR CONDITIONING
1900 Prairie Avenue Chicago, Illinois

Increases Film Strength of Mineral Oil

A new series of industrial lubricants which have high film strength due to a special polymerization treatment have been announced by the research staff of E. F. Houghton & Co., Philadelphia, Pa. These new products are made of pure mineral oil which is polymerized under carefully controlled heat and pressure. This treatment results in a re-arrangement of the molecules of the oil without change in its chemical content to produce a closer bond between the molecules and a consequent increase in film strength. The illustration shows the film-forming properties of a mineral oil before and after treatment.



These "Sta-put Lubricants" are made in three series and are available in grades for nearly every type of industrial equipment.

Offers a New Agitator

The latest addition to the extensive line of agitators, mixers and stirrers manufactured by The Patterson Foundry & Machine Company, East Liverpool, Ohio, is a "unipower agitator" which has been used for several years with Patterson machinery and is now offered as a separate agitator for all purposes.

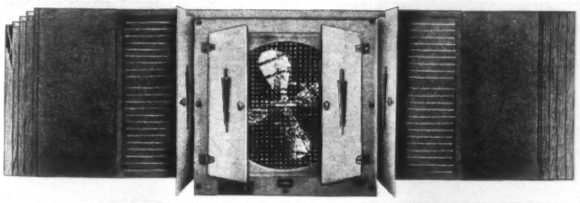
The agitator is built in both vertical and horizontal types and, when using 1800 rpm motors, will produce shaft speeds down to less than one revolution per minute if desired, without the use of gears. While one-way or two-way agitation can be accomplished without noise, vibration or grease slop and heavy, continuous loads or momentary overloads as high as 400 per cent can be carried, the unit is compact and light, making it especially suitable for installation over tanks and vats.

The units are built in sizes of 40 hp down to fractional sizes in several frame types, and require no additional bearings or flexible couplings for installation.

Unit Humidifies Air

A window unit which takes in outside air, filters, warms, and humidifies it and then circulates it to the room has been developed by The Burrowes Corporation, Portland, Me. The fan may be reversed, making the unit exhaust air from a room.

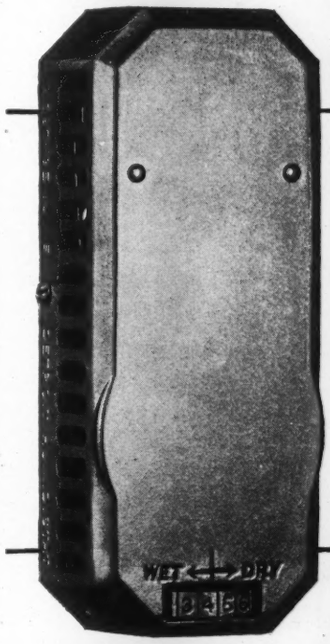
The unit comes in one standard size to fit any window. The



water tank has an approximate capacity of 1½ gallons; a red light gives warning when the water is low and the electric vaporizer is automatically turned off. The filter used is glass wool.

A Photo-Electric Kit

The Weston Electrical Instrument Corporation, 614 Frelinghuysen Ave., Newark, N. J., now offers a "photronic" control kit for those engineers and manufacturers who prefer to do their own experimenting with photo-electric control for mechanical equipment, operations and for processes of various kinds. The kit contains all the equipment necessary for the engineer to start imme-



LOW-PRICED
DEPENDABLE
CONTROLS
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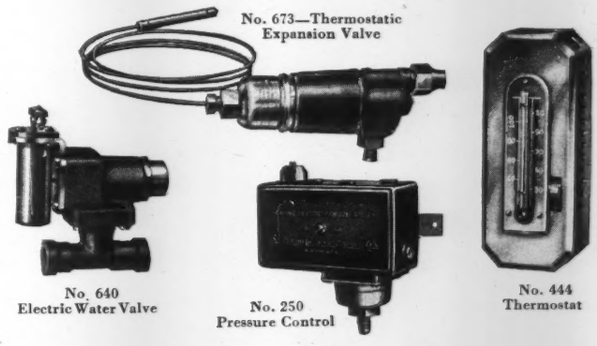
"GENUINE DETROIT"
COMPLETE AIR CONDITIONING CONTROLS

BEFORE you plan your next heating or air conditioning installation, get all the facts about low-priced, accurate "Genuine Detroit" Controls. Whether the problem calls for automatic control of heating, cooling, humidity or complete air conditioning, there is a "Genuine Detroit" Unit to do it better.

The complete line of "Genuine Detroit" Air Conditioning Controls includes among others the No. 673 Thermostatic Expansion Valve, No. 697 Humidistat, No. 640 Electric Water Valve and No. 250 Control Switch. Send today for Bulletins Nos. 39-B, 51, 50 and 61.



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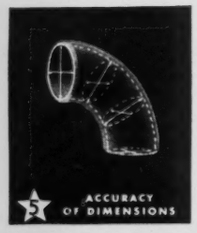
Canadian Rep.: Railway & Engineering Specialties, Ltd., Montreal, Toronto & Winnipeg
Lubricators • Carburetors • Valves
Automatic Controls for temperature, pressure, humidity
Refrigeration, Oil Burner and Heating Accessories

PIPE WELDING *is no longer* AT THE MERCY OF THE WELDER'S SKILL



Also made from BYERS GENUINE WROUGHT IRON PIPE

When you demand or specify Taylor Forge Fittings at every point that fittings are required, you assure a specific and predetermined result.

You know that every weld will be sound and exactly like every other weld in the piping system. You know that the interior will not be restricted by crude mitres or sharp intruding branch pipes. You know that frictional resistance will be minimized. You know that the welds will be removed from the zones of stress, and that the regions of greatest stress will be properly reinforced.

The unduplicated combination of features illustrated opposite is your assurance of these specific—yes, essential—results. Note particularly the full pipe thickness and selective reinforcement. This means safety. Also note the machine-tool beveled ends that enable the welder to do absolutely uniform welding at high speed.

Remember that these basic betterments apply not only to Taylor Weldells, but also to Tay'or Tees, Reducing Nipples, and other fittings. Ask for data.

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SEAMLESS STEEL FITTINGS FOR WELDING

diate experiments, together with diagrams of connections. The equipment can be used as a smoke detector, burglar alarm, turbidity detector, door opener, counter for all classes of service, safety device on machines, etc.

The cell included in the kit has the faculty of transforming light energy directly into electrical energy and operates the relays without the use of any auxiliary apparatus or batteries. As far as is known, the cell has unlimited life and the output is constant according to the manufacturer.

A New Text and Reference on Air Conditioning

An up to-date treatment of air conditioning, suitable for text and reference use, is given in the new book *Air Conditioning*, by James A. Moyer and Raymond U. Fittz. The applications of air conditioning for human comfort and health primarily are dealt with, although one of the seventeen chapters is devoted to food factories and textile mills. Other chapters in the latter half of the book on applications of air conditioning relate to office buildings, theaters, restaurants, railroad passenger cars, air conditioning for residences, and residence heating with refrigration equipment (reversed cycle refrigeration).

The chapters on principles and fundamentals include air-conditioning principles, ventilation requirements, air filtration, cooling methods, refrigeration for air conditioning, properties of refrigerants, refrigerating equipment (the same authors have written a book on refrigeration), temperature- and humidity-control equipment, design of temperature- and humidity-control systems (with several examples), and fans and auxiliary equipment.

The authors have made extensive reference to the research work of the *American Society of Heating and Ventilating Engineers;* acknowledgment to the *Guide* of the *A.S.H.V.E.* is given in the preface as is acknowledgement to HEATING, PIPING AND AIR CONDITIONING. The book is very readable and includes a number of tables and diagrams, in addition to an appendix and several large charts.

The publisher is McGraw-Hill Book Company, 330 W. 42nd St., New York City. There are 375 pages, 6x9. Price, $4.00.

Handbook of Arc Welding Design and Practice

The *Procedure Handbook of Arc Welding Design and Practice,* consisting of 434 pages and including about 500 half-tone illustrations and drawings, is divided into eight principal parts or sections as follows:

Part I, Welding Methods and Equipment; Part II, Technique of Welding; Part III, Welding Procedure, Speeds and Costs; Part IV, Structures and Properties of Weld Metal; Part V, Weldability of Metals; Part VI, Designing for Arc-Welded Steel Construction of Machinery; Part VII, Design for Arc-Welded Fabrication of Steel Structures, and Part VIII Typical Applications of Arc Welding in Manufacturing, Construction and Maintenance.

Considerable fundamental information is given as is data on welding for various applications, as will be noted from the above titles of the sections of the book. In the application sections, data on arc welding for pipe lines is included.

The book is 5¾x9 in size, bound in semi-flexible imitation leather. The price is $1.50, domestic postage prepaid, foreign postage 35c. The publisher is The Lincoln Electric Company, 12818 Coit Rd., Cleveland, Ohio.

Chicago's Great New Post Office

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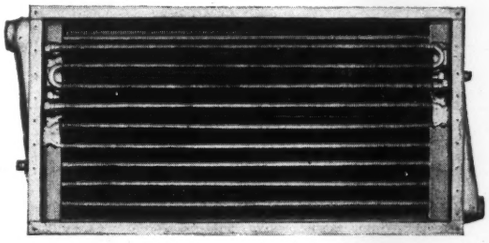
Fan Blast Heat Surface

Installed Throughout



Universal Aerofin

AEROFIN, the original, modern, scientific Fan System Heat Surface, was chosen by Architects, Graham, Anderson, Probst & White, for Chicago's great new Post Office Building and installed under the general contract of John Griffiths & Son Company by H. P. Reger & Company, heating contractors.

AEROFIN won out again, as in hundreds of installations, because of superior design and workmanship and for its exclusive features.

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NRA WE DO OUR PART

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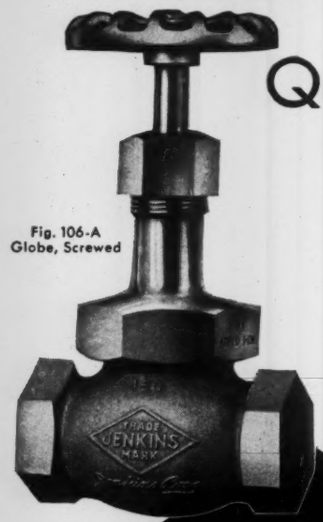

Fig. 106-A
Globe, Screwed

Quality pays even today

There is QUALITY in Fig. 106-A Jenkins Bronze Globe Valve ...extra deep stuffing box...slip-on stay-on disc holder...one-piece screw-over bonnet...Jenkins Disc.

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BRONZE IRON STEEL
VALVES
Since 1864

Always marked with the "Diamond"

Announcing
a Complete Line of
FEDDERS
Forcedraft
UNIT COOLERS

You will find a Fedders model for maintaining uniform refrigeration, thus reducing spoilage with minimum space and cost. Ideal for pre-cooling beer in keg storage boxes. Also for cooling grocers', butchers' and florists' walk-in refrigerators and display cases. Write for specification sheet.

Important Features

1 Fedders exclusive inclined element eliminates louvers

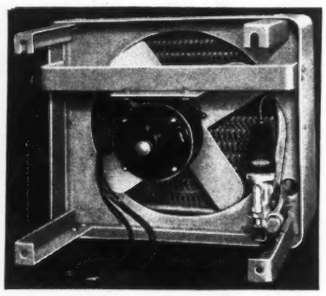
2 Continuous tube cooling element eliminates soldered loops

3 Condensate drains from rear of fins

4 Metal-to-metal bond between fins and tubes

5 Insulated drip pan eliminates sweating

Send your blue prints for quotations on special room cooling and air conditioning evaporators and condensers.



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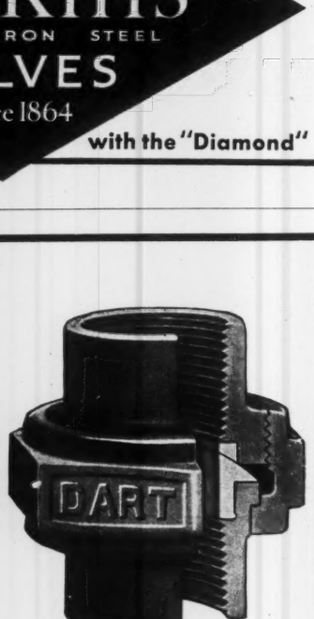
AVOID COSTLY BREAKDOWNS



Dart Unions are your best insurance against costly pipe line breakdowns. Because of their bronze-to-bronze seats the possibility of leakage by corrosion is eliminated. Take no chances. Install Darts every time.

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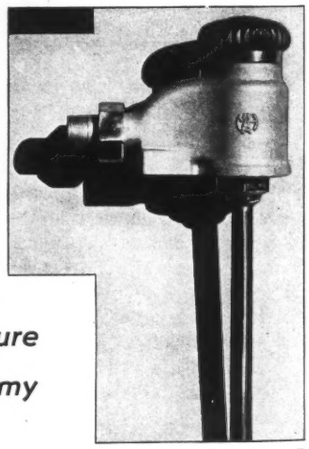
For Old Buildings or New, Large or Small . . .



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Accurate Temperature and Greatest Economy with the

MODUTROL SYSTEM

THE Minneapolis-Honeywell Modutrol System, with the Modustat automatic orifice system of individual room temperature control and electrical modulation of recirculating air systems, completely meets all the varied and exacting problems of providing correct and accurate temperature control. Installation, as well as operating costs are equally low in old or new, large or small buildings. . . . There is a Minneapolis-Honeywell engineer in your city, or near it, who can show you the advantages of the Modustat System. Minneapolis-Honeywell Regulator Co., 2701 Fourth Avenue South, Minneapolis, Minnesota.

MINNEAPOLIS-HONEYWELL
Control Systems

Transfer of Bureau of Standards Work to A. S. A.

THE announcement by Secretary of Commerce Roper that the simplified practice and industrial standardization work of the Bureau of Standards will be turned over to the *American Standards Association* has aroused many questions concerning the continuation of this work among groups which have participated in activities of the Bureau.

I am pleased to be able to state that provision is being made for assuring continuity on the technical projects. A skeleton staff to be maintained in the discontinued divisions and sections of the Bureau during a transition period will greatly facilitate the transfer. Individual projects in standardization and simplification can be carried on without any essential change in method. Plans are now being made for obtaining greater financial support for the *A. S. A.*, and when this is accomplished, it is hoped that the *A. S. A.* may be able to take over a number of the Bureau's personnel.

It is the belief of Secretary Roper, as well as myself, that this transfer will have far-reaching consequences for every branch of American industry concerned with standardization. The effect of the Secretary's decision is to concentrate the responsibility in a single organization representative of industry, the public, and the government. The consolidation of functions in the hands of a single organization is especially important since it comes at a time when the national economy demands a sharp acceleration in standards-making to keep pace with the need for industrial agreements under the National Recovery Act.

We feel that this work is vital to American industry—that the possibilities for joint action opened up by the National Recovery Act will be greatly broadened if industrial and other groups can cooperate in the establishment of a comprehensive system of fundamental technical standards; and we are happy to offer to all of these groups the machinery of the *American Standards Association* and the Bureau of Standards—now welded into a single unit.—*Howard Coonley, President, American Standards Association.*

Recent Trade Literature

Air Filters: Owens-Illinois Glass Company, Toledo, Ohio. Folder illustrating glass-wool air filters and the method of installation. Glass block and its use (of which this company's World's Fair building is constructed) is also described.

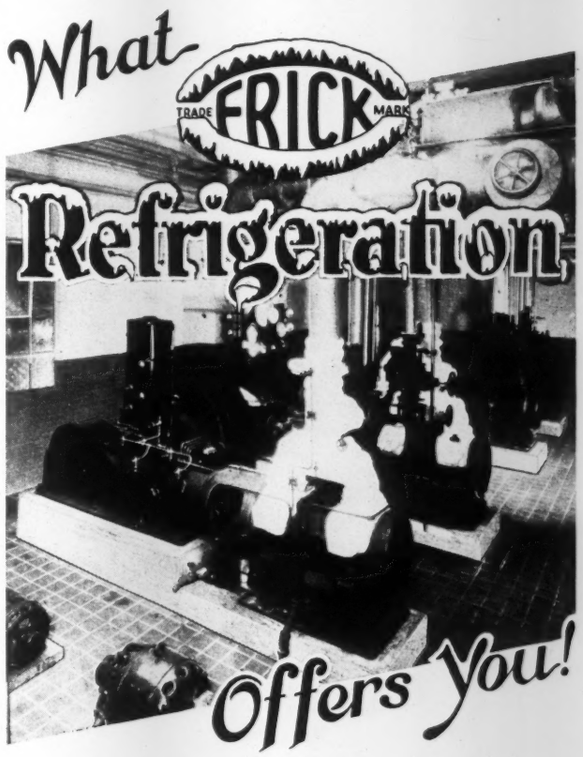
Boilers: The Titusville Iron Works Company, Titusville, Pa. Several new catalogs describing steel heating and power boilers, as follows: Triple-service water-tube fire-box boilers with instantaneous heating coils; sectional water-tube boiler designed especially for replacement work—can be taken through 24-in. doorway—capacities 2,000 to 24,000 sq ft—especially adaptable to oil burning; small Scotch marine boilers for high-pressure industrial work; special vertical boiler for high-pressure oil-burning work; and horizontal boiler with large Dutch oven for oil burning.

Boilers: Fitzgibbons Boiler Company, Inc., 570 Seventh Ave., New York City. 4-page folder announcing a steel heating boiler for smaller public and commercial buildings, in types for all kinds of fuels and heating systems.

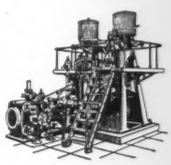
Condensation Return Units: Decatur Pump Company, Decatur, Ill. 4-page bulletin giving capacity table and description of condensation return units.

Control Equipment: Automatic Products Company, 121 N. Broadway, Milwaukee, Wis. New list prices on all control equipment, effective August 15.

Cooling Calculations: Dail Steel Products Company, Lansing, Mich. Data sheet for calculating the cooling load in the design of an air-conditioning system.



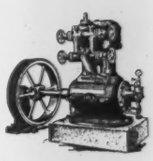
Experienced Engineering



Beginning in the early 80's, Frick Engineers pioneered with the Corliss engine driven compressors which remained the standard for the Refrigerating Industry for 35 years.

Up-to-the-Minute Equipment

Today, Frick Refrigerating Machinery offers you the last word in smooth, dependable operation, accurate control of temperatures, low horsepower required, attractive appearance, and overall satisfaction.



Data and Estimates

Including surveys of existing or proposed refrigerating systems are supplied without obligation to all interested parties. Discuss your cooling problems with a Frick Engineer now: Write

Frick Company
WAYNESBORO, PA. U.S.A.
ICE MACHINERY SUPERIOR SINCE 1882

NOISE

● This is a device for preventing NOISE made by steam passing through a pressure reducing valve. No moving parts.

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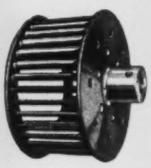

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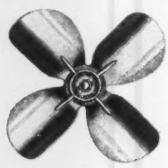
Patented All Aluminum Multiblade, Balanced Blower Wheels. Unexcelled for quiet and smooth operation.

30 years' experience building Propeller Fans, assembled, balanced and tested, ready to mount on motor shaft.



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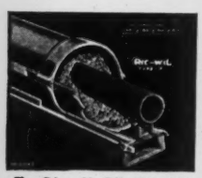

Ric-wiL Tile Conduit, Type F, Insulated with Dry-paC.

RIC-WIL TILE CONDUIT

with Loc-liP Side Joint, is a complete Conduit System providing ample protection for underground steam and hot water pipes. Completely engineered, it eliminates extras.

DRY-PAC INSULATION

is waterproofed, thus keeping steam pipes dry and maintaining the highest thermal efficiency. Write for complete details.

Tile Ric-wiL, Type F, with three pipes.

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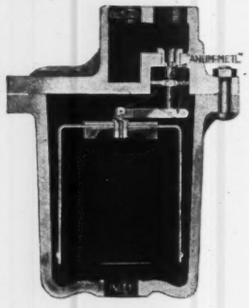
CONDUIT SYSTEMS FOR UNDERGROUND STEAM PIPES

STRONG
STEAM TRAPS



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Large Capacity
Non-Clogging
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THE STRONG, CARLISLE & HAMMOND CO.
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Gas Boilers: Steam and Combustion Company, 1559 Sheffield Ave., Chicago, Ill. 8-page booklet describing installations of this company's equipment for automatic steam generation at "A Century of Progress Exposition." Special articles describe the installation at the Firestone Tire and Rubber Company Exhibit, the gas burner for the Kewanee boiler supplying a steam-jet air-conditioning system, and the installation at The American Laundry Machinery Co. exhibit.

Gas Burners: Lee B. Mettler Co., 406 S. Main St., Los Angeles, Calif. 50-page booklet of burner specifications, installation drawings, and combustion engineering data for entrained combustion gas burners. The equipment and its principle of operation is explained and complete engineering data, installation information, and operating instructions are given. Under general information, sections on refractory materials, piping, draft and chimneys, etc., is given.

Grilles and Registers: Uni-Flo Grille Corporation, 4646 Lawton Ave., Detroit, Mich. 4-page folder of manufacturers' and distributors' list prices for grilles and registers.

Heating Calculations: Dail Steel Products Company, Lansing, Mich. Data sheet for calculating heating requirements of a building.

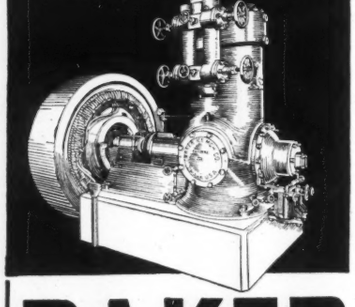
Ignition-Transformers: General Electric Company, Dept. 6-201, Schenectady, N. Y. 2-page announcement of new ignition-transformers for oil burners.

Motors: The Emerson Electric Mfg. Company, 2018 Washington Ave., St. Louis, Mo. 4-page bulletin announcing a new capacitor start, induction run motor available in 1/8, 1/6, 1/5, 1/4, and 1/3 hp sizes with resilient or rigid base mountings.

Photo-electric Relays: General Electric Company, Schenectady, N. Y. 16-page booklet giving considerable information on photo-electric relays, including sections on applications, principles of operation, descriptions of the equipment, characteristic curves, accessories, illumination data, etc.

Pipe: Taylor Forge & Pipe Works, P. O. Box 485, Chicago, Ill. 64-page book on riveted or welded spiral pipe giving general information and details about the pipe, forged steel flanges, pipe joints, fittings for light-weight pipe, bolts and gaskets, valves, lap-welded line pipe, lap-welded O. D. steel pipe, wrought-iron pipe lap welded, etc. A number of useful tables, charts, and other information is included. Numerous illustrations show applications, methods of shipping, etc.

Pumps: Chicago Pump Company, 2300 Wolfram St., Chicago, Ill. 400-page catalog containing complete information and engineering data on selecting pumps and pumping equipment, consisting of forty individual bulletins—each on a specific subject—bound in a loose-leaf binder. A special bulletin tells how to select a pump for a given service; useful information on pumps and hydraulics and engineering tables are included. Pumps and equipment included are sewage ejectors, bilge or sump pumps, screw-feed sludge pumps, horizontal centrifugal pumps, hot- or



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Refrigeration Units: Ingersoll-Rand Company, Phillipsburg, N. J. 12-page bulletin on steam-jet vapor refrigeration units which includes a discussion of water vapor refrigeration, importance of correct steam-jet design, operating characteristics of steam-jet boosters, and steam and water requirements. Arrangements and construction of the company's units is described and illustrated (including method of control) and a number of diagrams are included.

Refrigeration for Breweries: Frick Company, Waynesboro, Pa. 16-page bulletin describing and illustrating refrigeration equipment for breweries (including compressors, condensers, baudelot and double-pipe coolers, water or brine coolers, unit air coolers and air conditioning, automatic water or brine coolers, unit air coolers and air conditioning, automatic controls, valves and fittings, and auxiliaries) and containing several useful tables.

Valves: Jenkins Bros., 80 White St., New York. 264-page catalog covering 400 valves in a wide range of types and patterns, Features of design and construction are described in full, and complete information is given about the metals used in making the valves. Recommended services, pressures, temperatures, and fluids for which the valves are used are given. The last section presents engineering data on piping and valves.

Valves for Breweries: Walworth Company, 60 E. 42nd St., New York City. Large chart showing the piping systems in a brewery with the recommended types of valves.

Water Heaters: General Electric Company, Schenectady, N. Y. 4-page bulletin on automatic electric water heaters for industrial use, including a description of the features, dimensions and capacities, switch equipment, capacity curves, prices, etc.

X-Ray Inspection: Industrial X-Ray Corporation, Chamber of Commerce Bldg., Los Angeles, Calif. 4-page folder describing equipment for X-ray inspection in industry.

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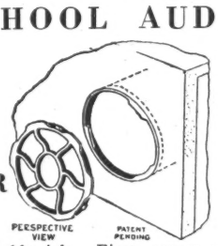

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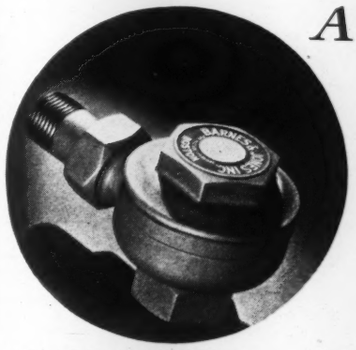

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